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TRANSACTIONS

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VOLUME LXVII

NOMENCLATURE IN THE ORTHOPTERA CONCERNING GENOTYPE DESIGNATIONS

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A desire of all those interested in systematic studies is stability in nomenclature, and wherefore these frequent and annoying changes that so often occur. Though we may frequently point to the errors or omissions committed by authors in the past, more often than not they were conforming with the system or conventions of their time. On second thought it becomes clear that much of the trouble has been caused by the gradual evolution or change in the naming system itself. Since this is so, we wonder for the future. It is with the hope that our present rules of nomenclature will become relatively fixed that it seems worth while to attempt to rectify the application of certain generic names in the light of our present system, the International Code of Nomenclature.

SCOPE OF STUDY

The purpose of this paper is to bring attention to early genotype designations that have been generally overlooked in the Orthoptera.

Issued June 16, 1941

Names with other problems of nomenclature have for the most part been excluded. The original objective of the paper was to include only the names which had type designations indicated by Latreille 1810, Curtis 1824–1839 and Westwood 1838. All of the type selections of these authors are cited in this paper. However, during the course of this study other sources of type designations were encountered and it seemed desirable to include certain of these other names where a possible change in their application was thereby caused. It would have made this paper more complete to have included in so far as possible all of the names which had type designations cited for them prior to Kirby's Catalogue, but it was not found practical to make this such an extensive paper and at the same time by including some of these other names it was felt that it would focus attention on these other sources of type designations. I wish to emphasize here that the principal aim of this investigation has been to present the facts concerning the type designations of these names as completely as possible and only secondarily to suggest what appears to be their proper application. It was felt that if this information was brought to light that a general agreement could be reached or at least differences of opinion would not be caused by lack of this information. Forty-one generic names are here treated and three generic names are proposed as new.

Concerning Certain Problems of Nomenclature

When one points out an error in the application of a generic name, one is naturally forced to point out what appears to be its correct application. Difficulty is encountered, however, when other nomenclature problems are incidentally connected with the name. It therefore becomes most important to take a logical and consistent stand regarding the more controversial aspects of the Rules and Opinions of the Code. In order to make clear the position taken in this paper a brief discussion of certain of these points is given below.

It is well to state at the outset that I accept on principle all Rules of the Code and Opinions of the Commission. One may not agree with all of the provisions there contained, but ignoring certain of them is hardly a reasonable solution. Rather let us make efforts to have these certain provisions modified or amended by the Commission if necessary.

Among the requirements for a valid proposal of a generic name is "that the author has applied the principals of binary nomenclature." [1] Some controversy has existed as to what constitutes binary nomenclature.[2] I assume that a generic name is valid so long as the author makes it reasonably evident that one or more species are included though not necessarily mentioned by name, that is, binary but not necessarily binominal (or binomial?). The name of course must be proper in other respects such as accompanied by a description or bibliographic reference.

In the selection of a genotype by an author as "rigidly construed," [3] I assume that the author must indicate a species name as genotype by use of the word "type" or "typical." Now if an author incidently gives a reason for his designation and this should later prove erroneous, in my opinion this in no way affects the status of the designation.[4]

The Code does not appear to be altogether clear on what is a genotype. I assume that it is a species name which naturally applies basically to the specimens or population described by the original authority of the name. Therefore if any author designates a certain species name as type, though it is quite evident that he has used the name erroneously for another species before him, the type must nevertheless apply to that species name he selects and not the actual specimens he had before him or the species he had intended. In connection with this interpretation, I also assume that, if an author cites for example Fabricius, 1775, as the authority for the species name indicated as type, but in reality Linnaeus, 1758, proves to be the original authority for the name, then the genotype applies basically to the species that Linnaeus described and not Fabricius. This is most important when the two authors applied the same name to two different species. It must be reasonably evident, however, that Fabricius for example has made an error in the application of Linnaeus' name rather than intending to describe a new species and accidently proposing a name which is a homonym of Linnaeus' name.

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[1] Article 25b of the International Code.

[2] See Opinions 20, 24 and 35.

[3] Article 30 IIg of the International Code.

[4] See discussion beyond under Kirby 1890 in the literature cited.

In respect to the names that are available for type by subsequent designation, I assume that any species name is available that was originally included within the genus regardless as to whether it was considered a valid name or merely cited as a synonym.

Concerning the power of suspension of rules by the Commission, it is very evident that this procedure is being used to an increasing extent in order to arbitrarily preserve the usage of many generic names. Though I of course accept such actions that have already been taken on generic names, I feel strongly opposed to this manner of procedure for the future. It is my humble opinion that the function of the Commission should be concerned with the interpretation of the rules of the Code in a fashion similar to that of any court which arrives at its decisions on the basis of its legal system. Of course one appreciates the fact that the power for suspension of rules is granted to the Commission under a provision of the Code itself. However, if the International Code is to be thought of as a legal system, this power granted to the Commission is certainly a paradox. Aside from this aspect of the matter, there is another feature that becomes important. In what logical or impartial way could one decide as to whether rules should be suspended for any given case on the basis of whether "strict application of the Rules will clearly result in greater confusion than uniformity" or not. As for example, in reviewing the names treated in this paper, there is no clear cut manner for deciding what names should be placed before the Commission on the above premise for possible suspension of rules, and am convinced that any arbitrary list of names selected by me for such action would differ considerably from another student from some other part of the world. For any one individual or group to arbitrarily decide on the use of a name will as often as not be resented by those individuals not included in the powers that be. Thus it will tend to weaken our efforts for uniformity and adherence to our present system of nomenclature.

Concerning the part of Opinion 124,[5] which does not accept the generic subdivisions of Linnaeus, 1758, it is necessary to make clear what attitude is taken in this paper, since there are six well known names concerned. These are *Mantis, Bulla, Acrida, Locusta, Tettigonia* and *Acheta,* all included under the inclusive genus *Gryllus.* Now if we are to strictly apply this Opinion to these names, we must consider them valid from the first time they are properly used or proposed subsequent to Linnaeus, 1758. This, however, is most difficult. In the first place Linnaeus treated these names in essentially the same manner in his 12th edition, 1767, with the exception of *Mantis* which was raised to full generic rank. If they are not to be accepted as of 1758, it is hardly reasonable to accept them in the same form at a later date. Now if we depend on other authors to validate these names, we find much confusion ensuing. Geoffroy, 1762 (thus even before Linnaeus, 1767), used the name *Locusta* for the katydids or tettigoniids, he used the name *Mantes* instead of *Mantis* and incidentally used the name *Tetigonia* (with one "t") for a genus in the Homoptera. Fabricius, 1775, applied *Tettigonia* (spelled thus) in the same manner as Geoffroy. Both Curtis and Kirby in 1825[6] seem to be the first subsequent authors after Linnaeus to use the name *Acrida.* They applied it to the tettigoniids with *Locusta viridissima* Fabricius cited as type and example respectively. Thus as far as the Orthoptera are concerned this Opinion causes much added difficulty and confusion. According to the Opinion, however, ". . . if any group of specialists finds that because of the literature on said group this Opinion will produce greater confusion than uniformity, the Commission is prepared to take up individual cases under arguments which may be submitted."

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[5] Summary of Opinion 124: "The various subdivisions of genera published by Linnaeus in 1758 are not to be accepted as of this date (1758) as of subgeneric value under the International Rules," *Smith. Miscl. Coll.*, vol. LXXIII, no. 8, p. 1, 1936.

I feel that the simplest and most direct solution of the matter would be to apply to the Commission to have all of these names of the Orthoptera accepted as of Linnaeus 1758. This action may technically demand a suspension of rules, but since the Orthoptera names reasonably conform with the Rules of the Code, it may be looked upon more as a modification or reversal of part of Opinion 124. Aside from this it would seem to be the most impartial way of dealing with the matter without causing complete chaos in the application of these names. For the interim I have therefore recommended in this paper that these names of Linnaeus in 1758 be recognized, until we have the opportunity to apply to the Commission for some such action as suggested above.

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[6] Kirby, Zool. Journ. I, (4), p. 432, 1825. For Curtis locus cited under *Acrida.*

EXPLANATION OF TREATMENT

In order to give as complete a history as possible of each name all type designations are cited for each generic name whether valid or otherwise. The species name following the word "TYPE" is considered as the proper genotype. This genotype is always cited in the generic combination of the designator. If this combination is not the present accepted combination, then this is given in brackets following. Also if the genotype combination is not the original combination under which the name was first described then this original combination of the species name is also cited and followed by the words "orig. comb." In some cases the species name which is the genotype may be considered a synonym of some other species name in which case the latter is also cited. All such indications of synonomy, however, are outside the scope of nomenclature and hence the problem of this paper. Therefore the synonymic status of these names are in no sense final and merely reflect the opinions in the more recent literature. Following the genotype and names in brackets, the form or manner of designation is stated and when it is by subsequent designation the author and bibliographic reference is given. If the date and page reference only is given, then refer to that author and date under Literature for the full citation.

ACKNOWLEDGMENTS

An effort was made to obtain the opinions of other workers in Orthoptera and I am deeply grateful for their most valued assistance. I am especially grateful to Dr. B. P. Uvarov of the British Museum (Natural History) for many helpful criticisms and for references to some most important literature. To Dr. Ashley B. Gurney and with the generous assistance of Mr. P. W. Oman both of the U. S. Department of Agriculture, Bureau of Entomology and Plant Quarantine, I am very greatly indebted for carefully examining my manuscript and making very many valuable suggestions which added greatly to the completeness of the paper. Again for many enlightening discussions and help I wish to thank Mr. Vernon S. L. Pate and Mr. John W. H. Rehn of Cornell University and research associates of this Academy. Finally to

Mr. James A. G. Rehn and Mr. Morgan Hebard of this Academy I wish to express my gratitude for their ever helpful advice and stimulation especially during the progress of this work. I should, however, make it clear at this point that the opinions expressed in this paper for the most part are in accord with those with whom I have consulted, but this is not true in every case and thus do not wish to imply that the conclusions reached here reflect completely the opinions of these other authors.

LITERATURE

The following list of literature includes the more important sources of early subsequent genotype designations. In addition to these sources many of Rehn's earlier systematic papers just prior to Kirby's' Catalogue of the Orthoptera should be consulted. Though it contains no designations, Berthold's translation of Latreille is here included to bring it to notice, because of its many generic names proposed for the first time. It should be mentioned that all of the designations made by Audouin or Guérin 1822–1831, Brullé 1835, Blanchard or Doyère in Cuvier 1836–1849, Blanchard or Duponchel in d'Orbigny 1841–1849 and later authors here cited are not all included in this paper.

LATREILLE 1810. Considération général sur l'ordre naturel des animaux composant les classes des crustacés, des arachnides, et des insectes avec un tableaus méthodique de leurs genres, disposés en familles.

This work contains a table of genera in the back portion of the volume, pp. 421–444, with the title: "Table des genres avec l'indication de l'espèce qui leur sert de type." The generic names are in the vernacular form, but the corresponding Latin form may be found in the main text of the volume. Following each generic vernacular name in the table is a species name, the genotype. The manner in which these type designations of Latreille were made have been approved by the International Commission in Opinion 11.

AUDOUIN (or GUÉRIN) 1822–1831. Dictionaire Classique d'Histoire Naturelle par messieurs Audouin, Guérin [and others], vols. I–XVII, 1822–1831.

In the discussion of many of the Orthoptera genera scattered alphabetically through these volumes are a number of type designations.

Berthold 1827. Larteille's natürliche Familien des Thierreichs aus dem Französichen mit Unmerkungen und Zusätzen.

Latreille in his work of 1825[7] described or gave a key to many genera some of which are new or described for the first time, at least in the Orthoptera. This work of Latreille, however, has little or no nomenclatorial status, since in almost all cases a vernacular name was used only and but very few species were cited. Berthold's translation of Latreille into German is very close to the original with the exception that the vernacular names are latinized. This therefore makes these latinized names for Latreille's new genera valid for the first time. Berthold, therefore, must be cited as the authority dating from 1827. Latreille[8] two years later treated the Orthoptera in a much more expanded form, giving latinized names and including species under the genera. It is unfortunate that the names for Latreille's genera cannot be based on this latter work especially since the latinized form of the vernacular names of Berthold and Latreille did not always coincide, as for example *Oedipus* and *Oedipoda*. Incidently many of the names proposed by Berthold had no indicated or included species, but they are certainly used in the binary sense, accompanied by a key or description and hence should be considered valid.

Curtis 1824–1839. British Entomology, vols. I–XVI.

A very large number of genera of many orders are treated in this work. The genera are not arranged in any systematic order so that it is necessary to refer to the systematic table in a volume entitled, "A Guide to an Arrangement of British Insects," p. 80, 2nd ed., 1837, to locate those of the Orthoptera. For each genus there is a type species cited.

Brullé in Audouin 1835. Histoire Naturelle des Insectes, vol. IX.

Only a portion of the genera treated in this work have types designated and the manner in which it is done is far from uniform. In some cases the type is indicated in a footnote; it may be indicated at the end of the descriptive discussion of the genus; or it may be in the running text where a group of genera are discussed. It is difficult to be sure of catching all of the designations in such a work.

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[7] Latreille 1825, Familles Naturelles du Règne Animal.

[8] Latreille 1829, Le Règne Animal, v.

WESTWOOD 1838. An Introduction to the Modern Classification of Insects, vol. II, Synopsis of the Genera of British Insects.

The synopsis which is contained at the back of the volume with separate pagination (pp. 1–158) cites the "typical species" of each genus on the basis of a footnote to the title on page 1. The form of these type designations have been approved by the International Commission in Opinion 71. I am indebted to Mr. Vernon S. L. Pate for calling to my attention the publication of Poulton and Griffin[9] for the dates of the various parts of Westwood's work and as there pointed out the date for the Orthoptera designations is 1838 and not as usually quoted 1840.

BLANCHARD (or **DOYÈRE**) in Cuvier 1836–1849. Le Règne Animal—etc., par Georges Cuvier. [3rd] edition accompagnée de planches gravées, représentant les types de tous les genres, les caractères distinctive des divers groupes—etc., par une réunion de disciples de Cuvier, [then is listed nine "disciples" including Blanchard and Doyère who each did a part of the Orthoptera], Paris [no date], vol. Insectes, Atlas 2.

Unfortunately I have not found any publication that indicates the exact date of this part, but see note under this work in Sherborn's Bibliography in the Index Animalium. As may be seen from the title of this volume of Cuvier cited above, the names of the figured species might be taken as the types of the genera. Whether this note on the title page is adequate for type designations may be open to some question. It is fortunate, however, that for one reason or another none of the types indicated for the Orthoptera appear to be valid with the possible exception of *Oedipoda,* a discussion of which may be found under that genus.

BLANCHARD (or **DUPONCHEL**) in d'Orbigny 1841–1848. Dictionaire Universel d'Histoire Naturelle, par messiers Blanchard, Duponchel [and many others], dirigé par M. Charles d'Orbigny, vols. I–XIII, 1841–1849.[10]

The Orthoptera are treated alphabetically and scattered throughout these volumes. There are many type designations casually indicated in the discussion of many of the genera. It should be emphasized that only the designations for genera treated here in this paper are cited and not all of the designations to be found in the work.

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[9] Poulton and Griffin, *Proc. Ent. Soc. London,* VI, p. 83, 1932.

[10] For a discussion of the dates of these various volumes see Sherborn and Palmer. Ann. Mag. Nat. Hist., (7), III, p. 350, 1899.

GIRARD 1879. Traité Élémentaire d'Entomologie, II (Orthoptera pp. 1–259).

This work treats a large number of genera and in the running discussion of some of these genera their genotype is designated. This is one of those cases where it is purely a haphazard manner of type selections.

KIRBY 1890. Sci. Proc. Royal Dublin Soc., (new series), VI, pp. 556–597, 1890. On the employment of names proposed for genera of Orthoptera, previous to 1840.

Kirby at this time was endeavoring to narrow or restrict the use of older generic names to type species by the older method of elimination. It is quite evident that he did not consider that he himself was making the selection of the type, but rather always cited some older authority as having done so. In all cases that I have examined, however, these older authorities did not actually make a formal selection of type in the light of our present system, the International Code. It now appears that unintentionally Kirby himself was in many cases making the first valid type designation. His reasons for so doing and their correctness would appear to me to have no bearing on the matter. There are, however, a number of cases where he has indicated two or more species as type and left the matter open as to which one shall become the single type. It is obvious that such cases must be considered improper and as having no status. It is very unfortunate that Kirby did not follow a number of these type selections in his later Catalogue of the Orthoptera as of course the 1890 designations have priority over his later designations.

KRAUSS 1902. Zool. Anz., XXV, pp. 530–544. Die Namen der altesten Dermapteren- (Orthopteren-) Gattungen und ihre Verwendung fur Familien- und Unterfamilien-Benennungen auf Grund der jetzigen Nommenclaturregeln.

A number of types of the older generic names are here indicated by Krauss, all of which are included in this present paper.

KIRBY 1904. Synonymic Catalogue of the Orthoptera, vol. I.
KIRBY 1906. Synonymic Catalogue of the Orthoptera, vol. II.
KIRBY 1910. Synonymic Catalogue of the Orthoptera, vol. III.

In the above three volumes of his catalogue, Kirby indicated the type by referring to the species by number. This in some cases brings about considerable ambiguity as to which name may be considered the type when there are two or more names in the synonomy of that species which might properly be available as type. Purely from a logical approach, the following system has been applied. Where the name that has been considered valid for the species by Kirby is available as the type as well as one or more synonyms listed under that name, then the name considered as valid for the species is taken to be the type and not of course the synonyms. Where the species name that is considered as valid by Kirby is not available or proper to serve as the genotype and there is but one available synonym listed in the synonomy, then this latter is taken as the type. If, however, there are two available synonyms listed and the species name considered valid by Kirby is not available, then the type indication is considered as improper, since there are two alternatives of equal status.

SUMMARY OF CHANGES IN NOMENCLATURE

PHASMATIDAE

Bacteria Berthold. Berthold is considered the authority and not St. Fargeau and Serville.

Phasma Lichtenstein. The proper genotype is *P. empusa* and not *P. rossia.* Hence the name should be applied to what has been called *Cyphocrana* St. Fargeau and Serville, the latter name becoming a synonym by priority. *Phasma* has been applied to *Bacillus* Berthold, which latter name now becomes valid for that genus.

PNEUMORIDAE

Bulla Linnaeus. Considered suppressed as of Amendment to Article 36 of the Code. Incidentally if *Bulla* were a valid name, it would be correctly applied to *Pneumora* of recent authors, but not of Thunberg.

Bullacris new name. Replaces *Bulla* of recent authors, but not of Linnaeus 1758.

Pneumora Thunberg. Since the proper genotype is *P. sexguttata,* a synonym of *P. inanis,* this generic name should be applied to the genus that has been called *Cystocoelia* Serville, the latter name becoming an absolute synonym by priority.

Cystocoelia Serville. See *Pneumora* Thunberg above.

Physemacris new name. Replaces *Bulla* Linnaeus, 1758, but not as used by recent authors. This genus has been improperly called *Pneumora* by recent authors.

TETRIGIDAE

Tetrix Latreille. Since *Acrydium* Geoffroy should not be applied to this genus, *Tetrix* is the next available name. Also since the name *Acrydium* is no longer within the family which has been called *Acrydiidae,* the family name *Tetrigidae* may now be used.

PROSCOPIIDAE

Proscopia Klug. The proper genotype is *P. gigantea* and not *P. oculata.* Both of these species names, however, are now considered congeneric by recent authors.

Taxiarchus Brunner. This name is virtually an absolute synonym of *Proscopia.*

ACRIDIDAE

Acrida Linnaeus. It is suggested that the authority for this name be continued as of Linnaeus 1758 pending a modification of Opinion 124 by the Commission.

Truxalis Fabricius. The genotype for this name is *Gryllus* (*Acrida*) *nasutus* Linnaeus, 1758, and it thereby applies to the genus known as *Acridella* Bolivar, the latter name becoming a synonym by priority.

Acridella Bolivar. Refer to *Truxalis* above.

Gomphocerus Thunberg. The genotype is *G. sibericus* and not *G. rufus* and thus the name should be applied to the genus called *Aeropus* Gistel. This latter name falls as an absolute synonym of *Gomphocerus* by priority.

Gomphocerippus, new name. Replaces *Gomphocerus* of recent authors, but not of Thunberg.

Mecostethus Fieber. Genotype *M. parapleurus* a synonym of *M. alliaceus.*

Parapleurus Fischer. An absolute synonym of *Mecostethus* by priority.

Stethophyma Fischer. Genotype *S. grossa.* This and the above two names have been used properly as here indicated by some recent authors.

Acrydium Geoffroy. Genotype *Gryllus* (*Acrida*) *stridulus* Linnaeus. This name should be applied to *Psopha* Fieber of the *Oedipodinae* and not to the genus of "grouse locusts" now called *Tetrix* of the family *Tetrigidae.*

Psopha Fieber. Refer to *Acrydium* above.

Oedipus Berthold. This name has remained binary but not binominal (no species names included) since it was proposed. *Gryllus* (*Locusta*) *migratorius* is here selected as type so as to dispose of it as a synonym of *Locusta.*

Locusta Linnaeus. It is suggested that the authority for this name be continued as of Linnaeus 1758 pending a modification of Opinion 124 by the Commission.

Pamphagus Thunberg. It appears that this name should be applied to *Porthetis* Serville. Since there is a difference of opinion as to the legality of its type designation it is recommended that it be used as of recent authors with *P. elephas* as type until a decision can be obtained from the Commission.

TRIDACTYLIDAE

Tridactylus Olivier. The type is considered to be *T. paradoxus* and not *T. digitata.*

TETTIGONIIDAE

Ephippiger Berthold. Berthold 1827 is considered to be the authority for this name and not Latreille 1829.

Phasgonura Stephens. *Tettigonia* has been recently applied to this genus, but this is considered to be an improper usage. The subfamily name should now become *Phasgonurinae* and not *Tettigoniinae.*

Tettigonia Linnaeus. This name properly applies to the genus *Decticus* Serville, this latter name becoming a synonym. Therefore the subfamily name *Decticinae* may not be used and *Tettigoniinae* should replace it.

Conocephalus fuscus (Fabricius), 1793. This species name, the type of *Xiphidion,* is a homonym and *Conocephalus discolor* Thunberg, 1815, is the next available name for the species.

Phaneroptera Serville. The proper genotype is *P. lilifolia* (Fabricius) which causes this name to apply to the genus called *Tylopsis* Fieber. Since the International Commission has been asked to suspend rules to make *G. falcatus* Poda the type, it is best to follow recent usage (*G. falcatus* as type) until a final decision is reached.

Pennicornu Berthold. This name is recognized but made a synonym of *Scaphura* Kirby.

GRYLLIDAE

Acheta Linnaeus. Since the name *Gryllus* Linnaeus should not be used for the genus which includes the species *G. domesticus* and *G. assimilis,* some recent authors have used the name *Gryllulus* Uvarov, 1935. *Acheta* is the earliest available name for this genus. It also is suggested that the authority for the name be taken as of Linnaeus 1758 pending a modification of Opinion 124 by the Commission.

HISTORY OF GENOTYPE DESIGNATIONS

Family BLATTIDAE

Subfamily ECTOBIINAE

Ectobius Stephens, Ill. Brit. Ent., vi, p. 45, 1835.

TYPE: *Blatta lapponica* Fabricius [= *Ectobius lapponicus* (Fabricius)], by first subsequent designation, Westwood 1838, p. 44. Later designated by: Kirby 1890, p. 562; Kirby 1904, p. 61.

Though Stephens, 1835, gives Westwood as the authority for *Ectobius,* it is apparently only from a manuscript name and therefore Stephens should be considered the authority. Westwood, 1838, made the above type designation for *Ectobia* Westwood, which name is obviously an emendation of *Ectobius* Stephens. Therefore *Ectobia* becomes an absolute synonym of the latter and Westwood's designation for *Ectobia* is valid for *Ectobius* Stephens. The International Commission has placed *Ectobius* Stephens on the Official List in Opinion 104 with the above genotype.

Subfamily BLATTINAE

Blatta Linnaeus, Syst. Nat., (ed. X), i, p. 424, 1758.

TYPE: *Blatta orientalis* Fabricius, 1775 [= *Blatta orientalis* Linnaeus, 1758], by first subsequent designation, Latreille 1810, p. 433. Later designated by: Audouin, vol. ii, 1822, p. 342; Westwood 1838, p. 44; Kirby 1890, p. 562; Kirby 1904, p. 137.

Blatta surinamensis Linnaeus [= *Pycnoscelus surinamensis* (Linnaeus)], later designated by Krauss 1902, p. 541.

Blatta germanica Linnaeus, 1767 [= *Blattella germanica* (Linnaeus)], improper designation by Girard 1879, p. 51.

The International Commission has placed *Blatta* on the Official List in Opinion 104 with the genotype *B. orientalis*.

Family MANTEIDAE[11]

Subfamily MANTEINAE

Mantis Linnaeus, Syst. Nat., (ed. X), i, p. 425, 1758.

TYPE: *Mantis religiosa* Linnaeus [= *Gryllus (Mantis) religiosus* Linnaeus, orig. comb.], by first subsequent designation, Latreille 1810, p. 433. Later designated by: Guérin, vol. x, 1826, p. 148; Krauss 1902, p. 541; Rehn 1901, Canadian Ent., xxxiii, p. 119; Kirby 1904, p. 249.

According to Opinion 124 *Mantis* should not be recognized as of subgeneric status or otherwise in Linnaeus of 1758. Geoffroy 1762[12] next used the name *Mantes*. I am uncertain as to the status of this name being apparently in the plural. Linnaeus in his 12th edition, 1767, used *Mantis* as of full generic status. However, it is here recommended that *Mantis* Linnaeus, 1758, be recognized pending an application for its acceptance by the International Commission.[13] Incidentally a report by Secretary Hemming on the action of the Commission at the International Congress at Lisbon[14] has been published placing *Mantis* Linnaeus, 1758, on the Official List. To use this authority and date for the name it would appear necessary to suspend rules and not merely to place the name as such on the Official List.

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[11] This is the proper form of the name and not *Mantidae*, since under Article 4 of the Code the name of the family is formed by adding the ending *idae* to the stem of the name of its type genus. The genitive singular of mantis is (μαντεως) manteus. Hence the stem is mante-.

[12] Geoffroy, Hist. Ins., i, p. 399, 1762.

[13] See discussion of Opinion 124 in the fore part of this paper.

[14] XII Congr. Int. Zool., Comptes Rendus, i (1st part), p. 190, 1936.

Subfamily EMPUSINAE

Empusa Illiger, Kafer Preussens, p. 499, 1798.

TYPE: *Mantis pauperata* Fabricius [= *Empusa pauperata* (Fabricius)], by first subsequent designation, Latreille 1810, p. 433. Later designated by Kirby 1904, p. 311.

Family PHASMATIDAE[15]

Subfamily BACILLINAE

Bacteria Berthold, Latreille's Nat. Fam. Thier., p. 408, 1827.

TYPE: *Phasma ferula* (Fabricius) [= *Mantis ferula* Fabricius, orig. comb. = *Bacteria ferula* (Fabricius)], by first subsequent designation, Blanchard in d'Orbigny 1842, vol. II, p. 413. Later designated by Rehn 1904, Proc. Acad. Nat. Sci. Phila., p. 61.

Bacteria baculus (Olivier) [= *Mantis baculus* Olivier, orig. comb.], improper designation by Kirby 1904, p. 355.

St. Fargeau and Serville[16] have been usually cited as the authority for this name, but, as pointed out by Sherborn and Woodward,[17] pages 345 to 832 of this publication were not brought out until 1828 though the volume is dated 1825. *Bacteria* Berthold had no included or indicated species, and St. Fargeau and Serville, locus cited above, were the first authors to indicate species for the genus. They referred to Latreille,[18] 1796, and indicated the species in the "second division" and "first subdivision" on page 88 which are: *Phasma filiformis, P. ferula* and *P. calamus.* For the clarification of what these authors meant by the terms "division" and "subdivision" refer to their treatment of *Phasma* pp. 100–101 in their same opus cited above. Blanchard, 1842, indicated as type "*B. arumatia* Stoll (*Phasma ferula* Fab.)." Blanchard evidently considered *P. ferula* a synonym of *B. arumatia* and since *P. ferula* was the only originally included one of the two names, I can see no serious objection for assuming that this designation of Blanchard is valid with *P. ferula* the type.

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[15] This is the correct form and not *Phasmidae,* as the stem is phasmat— formed from the genitive singular (φάσματος) phasmatos. See footnote under *Manteidae.*

[16] St. Fargeau and Serville, Enc. Méth. Ins., X, p. 445, 1828.

[17] Sherborn and Woodward, Proc. Zool. Soc. London, p. 595, 1899.

[18] Latreille, Gen. Crust. Ins., III, p. 88, 1796.

Subfamily PHYLLIINAE

Phyllium Illiger, Käfer Preussens, p. 499, 1798.

TYPE: *Mantis siccifolia* Fabricius, 1775 [= *Gryllus* (*Mantis*) *siccifolius* Linnaeus, 1758, orig. comb. = *Phyllium siccifolium* (Linnaeus)], by monotypy. Later designated by: Latreille 1810, p. 433; Guérin, vol. XIII, 1828, p. 454; Girard 1879, p. 111; Kirby 1890, p. 569; Kirby 1904, p. 422.

The International Commission has recently[19] placed *"Phyllum"* Illiger on the Official List with the above genotype, the necessity for which I have not ascertained. The omission of "i" in the name would appear to be a typographical error.

Subfamily PHASMATINAE

Phasma Lichtenstein, Cat. Mus. Zool. Hamb., III, p. 77, 1796.

TYPE: *Phasma empusa* Lichtenstein, by first valid subsequent designation, Kirby 1904, p. 390. Later designated by Karny 1923, Treubia, III, p. 241.

Phasma rossia (Fabricius) [= *Mantis rossia* Rossi, orig. comb. = *Bacillus rossia* (Rossi)], improper designation by: Latreille 1810, p. 433; Kirby 1890, p. 569.

Phasma phthisicum (Linnaeus) [= *Gryllus* (*Mantis*) *phthisicus* Linnaeus, orig. comb. = *Pseudophasma phthisicum* (Linnaeus)], improper designation by Krauss 1902, p. 541.

Many recent authors have followed Latreille's designation of *Phasma rossia* as genotype, but neither this name nor *P. phthisicùm* were originally included species and hence are improper designations. Thus *Phasma* should be applied to *Cyphocrana* St. Fargeau and Serville, 1828, and not *Bacillus* Berthold, 1827.

Family PNEUMORIDAE

Bulla Linnaeus, Syst. Nat. (ed. X), I, p. 427, 1758.

TYPE: *Gryllus* (*Bulla*) *variolosus* Linnaeus, 1758 [= *Physemacris*[20] *variolosa* (Linnaeus)], by first subsequent designation, Kirby 1890, p. 592.

Gryllus (*Bulla*) *serratus* Linnaeus[21] [= *Prionolopha serrata* (Linnaeus)], later designated by Rehn 1901, Canadian Ent., XXXIII, p. 120.

Bulla unicolor Linnaeus [= *Gryllus* (*Bulla*) *unicolor* Linnaeus, orig. comb. = *Bullacris unicolor* (Linnaeus)], later designated by: Krauss 1902, p. 541; Kirby 1910, p. 62.

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[19] XII Cong. Int. Zool., Comptes Rendus, I (1st part), p. 189, 1936.

[20] Refer to *Physemacris* proposed as a new name beyond.

[21] Not *Pneumora serrata* Thunberg, 1810, Vet.-Acad. Nya. Handl., XXXI, pp. 57 and 59.

The subgeneric name *Bulla* Linnaeus, 1758 (Orthoptera), has been suppressed as a homonym of the generic name *Bulla* Linnaeus, 1758 (Mollusca), by the International Commission on the basis of the amendment to Article 36 and adopted in 1930: "When homonyms are of the same date . . . , then any name proposed for a genus takes precedence over a name (its homonym) proposed for a subgenus." In addition to this it is recommended in Opinion 124 that this name, as a subgenus of Linnaeus 1758, be not recognized as having any status. As discussed in the introductory portion of this present paper, it is hoped to obtain a reversal of this part of Opinion 124. In any event *Bulla* (Orthoptera) would still remain suppressed under the amendment to Article 36. Incidently if this name were to be recognized, it would apply to the genus called *Pneumora* by recent authors owing to Kirby's 1890 designation cited above. The genus *Bulla* as defined by Stål and followed by Kirby and later authors needs a new name which is proposed below.

Bullacris new name

This is a new generic name proposed for *Bulla* as defined by Stål 1873 (Rec. Orth., I, pp. 136–137) and not of Linnaeus 1758.

TYPE: *Gryllus* (*Bulla*) *unicolor* Linnaeus, 1758 [= *Bullacris unicolor* (Linnaeus)].

Pneumora Thunberg, Vet.-Acad. Handl., p. 254, 1775.

TYPE: *Pneumora sex-guttata* Thunberg [= synonym of *Pneumora inanis* (Fabricius)], by first subsequent designation, Guérin, 1828, XIV, p. 91. Later designated by: Blanchard ? in d'Orbigny, 1847, X, p. 295.

Pneumora variolosa (Linnaeus) [= *Physemacris variolosa* (Linnaeus)], improper designation by: Brullé in Audouin, 1835, p. 221.

Pneumora maculata Thunberg [= synonym of *Gryllus* (*Bulla*) *variolosus* Linnaeus, 1758, = *Physemacris variolosa* (Linnaeus)], later designated by: Kirby 1890, p. 592; Kirby 1910, p. 63.

Not having the above cited paper of Thunberg 1775 available to me, Dr. Ashley B. Gurney very kindly supplied me with the information that Thunberg only included the following three species names in his original description of the genus *Pneumora: P. immaculata, P. maculata* and *P. sex-guttata.* Owing to Guérin's earliest type designation indicated above, *Pneumora* must be applied to the genus that has been called *Cystocoelia* Serville. This latter name falls as an absolute synonym of *Pneumora* by priority. The genus to which *Pneumora* has been applied by Stål and recent authors with *Gryllus* (*Bulla*) *variolosus* Linnaeus as type needs a new name which is proposed below.

Physemacris [22] new name

This is a new name for *Pneumora* as defined by Stål, 1873 (Rec. Orth., I, pp. 137 and 143), and not of Thunberg 1775.

TYPE: *Gryllus* (*Bulla*) *variolosus* Linnaeus, 1758 [= *Physemacris variolosa* (Linnaeus)].

Cystocoelia Serville, Ins. Orth., p. 713, 1839.

TYPE: *Cystocoelia inanis* (Fabricius) [= *Gryllus inanis* Fabricius, orig. comb., = *Pneumora inanis* (Fabricius)], by first subsequent designation, Kirby 1910, p. 65.

Though Serville, 1839, only included *Gryllus inanis* Fabricius as a synonym under *Pneumora* (*Cystocoelia*) *sex-guttata* Thunberg, it certainly can be considered as an originally included name and thus Kirby's designation is valid. As pointed out under *Pneumora*, *Cystocoelia* falls as a synonym of *Pncumora* by priority.

Family TETRIGIDAE

Tetrix Latreille, Hist. Nat. Crust. Ins., III, p. 284, 1802.

TYPE: *Acrydium subulatum* Fabricius [= *Gryllus subulatus* Linnaeus, orig. comb. = *Tctrix subnlata* (Linnaeus)], by first subsequent designation, Latreille 1810, p. 433. Later designated by: Brullé in Audouin 1835, p. 230; Westwood 1838, p. 45.

Since the generic name *Acrydium* [23] should be used for the genus *Psopha* Fieber in the Oedipodinae, *Tetrix* becomes the next available name for this genus of "grouse locusts." [24] Also since the name *Acrydium* is no longer in this family, the family name *Acrydiidae* (or *Acrydiinae* ?) may no longer be used. It is incidently fortunate to be able to eliminate this name as it so nearly resembles *Acrididae*. This generic change makes it now possible to use the family name *Tetrigidac*.

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[22] φισημα (inflated) + ακρis (locust).

[23] See discussion of this name under the *Ocdipodinae*.

[24] Τέτριξ (tetrix) means grouse like bird, hence the name "grouse locusts."

Family PROSCOPIIDAE

Proscopia Klug, Hor. Phys. Berol., p. 17, 1820.

TYPE: *Proscopia gigantea* Klug, by first subsequent designation, Guérin, vol. XIV, 1828, p. 297. Later designated by: Kirby 1890, p. 586.

Proscopia oculata Klug, later designation by Kirby 1910, p. 83.

The International Commission[25] has recently placed *Proscopia* on the Official List with *P. oculata* as the genotype and designated by Kirby 1910. I am uncertain as to whether the two earlier designations were intentionally ignored by the Commission, but in any event can see no reason for so doing. In recognizing Kirby's earlier designation, *Taxiarchus* Brunner becomes a synonym of *Proscopia,* but since Hebard 1924[26] considered *Taxiarchus* congeneric with *Proscopia* as used by Kirby 1910, it is therefore not necessary to propose a name for the part of the genus including *P. oculata.*

Taxiarchus Brunner, Verh. zool.-bot. Ges. Wien, XL, pp. 92 and 109, 1890.

TYPE: *Taxiarchus superbus* Brunner [= *Proscopia gigantea* Klug], by monotypy. Later designated by: Kirby 1910, p. 87.

Since *T. superbus* is considered a synonym of *P. gigantea, Taxiarchus* falls as a synonym of *Proscopia* by priority, as the latter species name is the genotype of *Proscopia.*

Family ACRIDIDAE

Subfamily ACRIDINAE

Acrida Linnaeus, Syst. Nat., (ed. X), I, p. 427, 1758.

TYPE: *Acrida turrita* Linnaeus, 1758 [= *Gryllus* (*Acrida*) *turritus* Linnaeus, orig. comb.], by first subsequent designation, Krauss 1902, p. 541. Later designated by: Kirby 1910, p. 90.

Gryllus viridissimus Linnaeus, 1758 [= *Gryllus* (*Tettigonia*) *viridissimus* Linnaeus, orig. comb., = *Phasgonura viridissima* (Linnaeus)], improper designation by: Curtis 1825, II, no. 82.

According to Opinion 124 this name as well as all other generic subdivisions of Linnaeus 1758 are considered to have no status as of this date. For a discussion of this Opinion refer to the introductory portion of this paper. It is there suggested that all subgenera of the Orthoptera as of Linnaeus 1758 be recognized in so far as this Opinion affects them until we can obtain a specific opinion from the Commission concerning these names.

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[25] XII Cong. Int. Zool., Comptes Rendus, I (1st part), p. 189, 1936.
[26] Hebard, Trans. Amer. Ent. Soc., L, p. 93, 1924.

Truxalis Fabricius, Syst. Ent., p. 279, 1775.

TYPE: *Truxalis nasutus* Fabricius, 1775 [= *Gryllus* (*Acrida*) *nasutus* Linnaeus, 1758, orig. comb. and authority = *Truxalis nasuta* (Linnaeus)], by first subsequent designation, Latreille 1810, p. 433. Later designated by: Brullé in Audouin 1835, x, p. 217; Blanchard in d'Orbigny 1848, XII, p. 710; Girard 1879, p. 217.

Gryllus brevicornis Linnaeus, 1763 [= *Gryllus brevicornis* Johannson, 1763, original authority = *Metaleptea brevicornis* (Johannson)], later designated by: Kirby 1890, p. 587; Rehn 1905, Proc. Acad. Nat Sci. Phila., p. 400; Kirby 1910, p. 103.

It now appears that the genus name *Truxalis* should be applied to the genus known as *Acridella* Bolivar. *Truxalis* until the last few years has been generally applied to an American species now called *Metaleptea brevicornis* (Johannson). With the discovery of Latreille's early designation it was next thought to be a synonym of *Acrida* with *Acrida turrita* as type. This was because the species indicated by Latreille was what he considered to be *Truxalis nasuta* Fabricius, 1775, which was equal to *Gryllus nasutus* Linnaeus, 1764, which in turn was the same species as *Gryllus* (*Acrida*) *turritus* Linnaeus, 1758. However, since the original authority for the name *T. nasuta* Fabricius, 1775, is really Linnaeus of 1758 and since a genotype is based on a species name, therefore the actual species to which the genotype name applies will depend on the description of the original authority for that name, that is, Linnaeus 1758, in spite of the fact that Latreille's intention was to have the species we now call *Acrida turrita* Linnaeus, 1758 as type. It must be born in mind that a genotype is a species name primarily and is not affected by the designator having used this name in error and indicated or described some other species. The species to which the genotype applies must depend on the original authority for that name. The cause of most of this confusion is due to the fact that the two species names *G. nasutus* and *G. turritus* of Linnaeus 1758 were transposed by accident or otherwise in his later edition of 1764 in respect to their descriptions so that what Linnaeus called *G. nasutus* in 1758 was *G. turritus* in 1764 and likewise *G. turritus* in 1758 was *G. nasutus* in 1764.

As mentioned, until recently *Truxalis* has been generally applied to the American species *Gryllus brevicornis* Johannson. Gurney[27] has pointed out that the generic name for this species should be *Metaleptea* Brunner, 1893.

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[27] Gurney, Entomologica Americana, XX, (3), p. 92, 1940.

Acridella Bolivar, Feuille Jeunes Nat., xxiii, p. 163, 1893.

Type: *Truxalis unguiculata* Rambur, 1839 [= synonym of *Truxalis nasuta* (Linnaeus), 1758], by first subsequent designation, Kirby 1910, p. 96.

It is necessary to stretch the point for this designation by Kirby, since it would appear as though he intended *Acridella nasuta* (Linnaeus) as the genotype, but this was not an originally included name by Bolivar. However, in as much that Kirby lists *T. unguiculata* as a synonym under *A. nasuta* and that name was an originally included one, it may well be construed as the genotype.

As noted under the name *Truxalis*, *Acridella* becomes a synonym by priority of that name.

Gomphocerus Thunberg, Mém. Acad. Pétersb., p. 221, 1815.

Type: *Gryllus sibericus* Fabricius [= *Gryllus* (*Locusta*) *sibericus* Linnaeus, orig. comb. = *Gomphocerus sibericus* (Linnaeus)], by first subsequent designation, Brullé in Audouin 1835, p. 229. Later designated by: Blanchard in d'Orbigny 1845, vi, p. 265; Kirby 1910, p. 581.

Gryllus rufus Linnaeus [= *Gryllus* (*Locusta*) *rufus* Linnaeus, orig. comb. = *Gomphocerippus rufus* (Linnaeus)], later designated by: Westwood 1838, p. 45; Kirby 1890, p. 591; Kirby 1910, p. 154.

Because of Brullé's earliest type designation, the name *Gomphocerus* will apparently have to be applied to the genus *Aeropus* Gistel[28] instead of the genus which has *Gryllus rufus* as type and the name *Aeropus* becomes an absolute synonym of *Gomphocerus* Thunberg.

The above type designation of Brullé requires some explanation. Brullé, as cited above, designates in a footnote the type of "Les Gomphocères" as *Gryllus sibericus* Fabricius. He treats "Les Gomphocères" as a "division" under the subgenus *Acridium* which in turn is included under the genus *Acridium*. In the discussion under the genus *Acridium* (p. 215) he mentions the subgenus "Les Gomphocères" proposed by Latreille (actually of course by Thunberg). Then in a footnote he gives as a synonym of the subgenus *Acridium* (p. 224) the latinized form *Gomphocerus* Latreille. Much as it may be desirable to consider this designation as improper, it does not seem logically possible to do so under these circumstances.

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[28] Gistel, Naturgesch. Tierreichs für hohere Schulen, p. 137, 1848.

Uvarov 1931,[29] in his preliminary revision of the genus *Aeropus,* states that Samouelle 1819[30] fixed the type of *Gomphocerus* as *rufus* Thunberg, though at the same time he indirectly implies that it was not a "formal" fixation. Examining Samouelle I find no evidence of a selection of type according to the rules of the Code. Since the genus called *Gomphocerus* by recent authors is left without a name, a new name for the genus is proposed below.

Gomphocerippus new name

This is a new name proposed for *Gomphocerus* as defined by Hebard[31] and recent authors and not *Gomphocerus* Thunberg, 1815.

TYPE: *Gryllus* (*Locusta*) *rufus* Linnaeus, 1758 [= *Gomphocerippus rufus* (Linnaeus)].

Mecostethus Fieber, Fieber in Kelch, Grundl. Orth. Oberschles., p. 1, 1852.

TYPE: *Gryllus parapleurus* Hagenbach [= *Mecostethus parapleurus* (Hagenbach), synonym of *Mecostethus alliaceus* (Germar)], by first subsequent designation, Kirby 1910, p. 144.

Kirby upset the more logical application of this name by his above type designation. Uvarov, 1924,* in his discussion of this name, *Parapleurus* and *Stethophyma* maintained that the species name, *Stethophyma grossa,* should be the genotype of *Mecostethus.* Dr. Uvarov (in litt.) now agrees that his conclusions at that time were not in strict accord with the present International Code and that Kirby's designation, indicated above, is the proper one. He now suggests, however, that by suspension of rules *Mecostethus* should be placed on the Official List with *S. grossa* as the genotype. I am on principle not in favor of such an action. As it now stands *Mecostethus* and *Stethophyma* are both valid names for two distinct genera and *Parapleurus* is an absolute synonym of *Mecostethus.*

Parapleurus Fischer, Orth. Eur., pp. 297 and 363, 1853.

TYPE: *Parapleurus typus* Fischer, 1853 [based on *Gryllus parapleurus* Hagenbach and synonym of *Mecostethus alliaceus* (Germar)], by original designation and monotypy.

This name is an absolute synonym of *Mecostethus* Fieber.

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[29] Uvarov, Eos, VII, p. 85, 1931.

[30] Samouelle, Entom. Useful Compendium, p. 219, 1819.

[31] Hebard, Ent. News, XLVI, (7), pp. 184–188, 1935.

* Uvarov, Ann. Mag. Nat. Hist., (9), XIII, pp. 246, 247, 1924.

Stethophyma Fischer, Orth. Eur., p. 297, 1853.

TYPE: *Gryllus* (*Locusta*) *grossus* Linnaeus [= *Stethophyma grossa* Linnaeus], by first subsequent designation, Kirby 1910, p. 167.

The name *Mecostethus* has been applied to this genus by most European authors in the past. *Stethophyma*, however, is the correct name for the genus under the rules of the Code and for further discussion refer to *Mecostethus* above.

Subfamily OEDIPODINAE

Acrydium Geoffroy, Hist. Ins., I, p. 390, 1762.

TYPE: *Gryllus stridulus* Fabricius, 1775 [= *Gryllus* (*Locusta*) *stridulus* Linnaeus, 1758, orig. comb. = *Acrydium stridulum* (Linnaeus)], by first subsequent designation, Latreille 1810, p. 433.

Gryllus bipunctatus Linnaeus [= *Tetrix bipunctata* (Linnaeus)], later designated by: Curtiss 1833, x, no. 439; Krauss 1902, p. 541.

Acrydium subulatum (Linnaeus) [= *Tetrix subulata* (Linnaeus)], later designated by: Rehn 1904, p. 666; Kirby 1910, p. 36.

Owing to the apparent oversight of Latreille's early designation, authors have applied this name to a genus of "grouse locusts" (*Tetrigidae*). This may have been due to the fact that they considered Fabricius 1775 to be the first author to indicate species for the genus instead of Geoffroy 1762 and *Gryllus stridulus* was not included in the former. It is true that Geoffroy was not using the binomial system himself (though certainly binary), but heading the descriptions of the various species he described, he cited previous literature, as for example: under species three of *Acrydium* he referred to Linnaeus' tenth edition, 1758, and followed this particular citation by "*Gryllus-locusta stridulus.*" I can see no reason for not considering this as a properly included species name within the genus by Geoffroy. It is unfortunate that this generic name should have to be applied to the long recognized genus called *Psopha* Fieber, which latter name falls as an absolute synonym by priority. Dr. Uvarov (in litt.) suggests that the name *Acrydium* be suppressed by suspension of rules in order to preserve the name *Psopha.* Incidently if *Acrydium* should be suppressed by the International Commission, then *Acridium* Shrank, 1801, should likewise be suppressed as it is clearly an emendation of *Acrydium.* Shrank's name would be validated by such an action on *Acrydium* alone.

Psopha Fieber, Fieber in Kelch, Grundl. Orth. Oberschles., p. 2, 1852.

TYPE: *Oedipora*[82] (*Psopha*) *stridula* (Linnaeus) [= *Gryllus* (*Locusta*) *stridulus* Linnaeus, orig. comb., = *Acrydium stridulum* (Linnaeus)], by monotypy.

This name is an absolute synonym of *Acrydium* by priority as discussed above.

Oedipoda Latreille, Règne Animal (nouv. ed.), v, p. 188, 1829.

TYPE: *Oedipoda caerulescens* (Linnaeus) [= *Gryllus* (*Locusta*) *caerulescens* Linnaeus], by first subsequent designation, Kirby 1910, p. 238.

The International Commission[83] has recently placed *Oedipoda* on the Official List with Serville 1831 as the authority and with the above type designation. For Serville being considered the authority, I can see no reason. The type designation would appear to be correct, but there is a problem that should at least be considered in respect to this name so as to avoid possible difficulty if encountered by subsequent authors. In the so called disciples edition (3rd) of Cuvier's Règne Animal, 1836–1849, it states on the title page of the atlas on insects (vol. 2) containing the plates, "Accompagnée de Planches gravées, représentent les Types de tous les Genres,—." On plate 86 is figured *Oedipoda migratoria* and on the page facing this is the species name and the figure number given under the genus name *Oedipoda* Latreille. Whether this can be construed as a proper type designation may be open to some question, but assuming that it is proper in so far as the general form is concerned, I am of the opinion that the species name *O. migratoria* was not properly an originally included one by Latreille under *Oedipoda* so that the designation may be considered as improper from this view point. Latreille definitely includes *Gryllus stridulus* and *G. caerulescens* under the genus *Oedipoda* and though he does discuss *Gryllus migratorius* on a preceding page, he certainly does not definitely state or clearly indicate that this species is also an included one. Aside from this particular case, it would be important to have a decision by the Commission concerning this publication of Cuvier as to the validity of these designations in general, although it would not appear to alter the application of any names of the Orthoptera.

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[82] *Oedipora* is evidently a typographical error for *Oedipoda* Latreille.

[83] XII Congr. Int. Zool., Comptes Rendus (1st part), p. 189, 1936.

Oedipus Berthold, Latreille's Nat. Fam. Thier., p. 411, 1827.

TYPE: *Gryllus* (*Locusta*) *migratorius* Linnaeus [= *Locusta migratoria* Linnaeus], by present designation.

This name is derived from the vernacular name "Oedipode" of Latreille 1825.[84] Berthold's name is accompanied by a very brief description, but no species are included nor have there ever been any placed in combination with it. It is evident from Latreille's later publication in 1829[85] that he had intended the genus for the species *Oedipoda caerulescens* and *Psopha stridula,* but there is nothing to indicate this in Berthold 1827 or Latreille 1825. Since the generic description accompanying the name *Oedipus* would fit almost any species of the *Oedipodinae,* I can see no legal objection to making the above type designation. By so doing it makes the name *Oedipus* isogenotypic with *Locusta* Linnaeus and it thus falls as a synonym by priority. The purpose of this is to preserve the name *Oedipoda* Latreille of 1829, which of course was likewise derived from Latreille's own vernacular name "Oedipode" of 1825.

Locusta Linnaeus, Syst. Nat., (ed. X), p. 431, 1758.

TYPE: *Gryllus migratorius* Linnaeus [= *Gryllus* (*Locusta*) *migratorius* Linnaeus, orig. comb. = *Locusta migratoria* Linnaeus], by first valid subsequent designation, Curtis 1836, XII, no. 608. Later designated by: Kirby 1890, p. 590; Kirby 1910, p. 228.

Locusta viridissima Fabricius [= *Gryllus* (*Tettigonia*) *viridissimus* Linnaeus, orig. comb. = *Phasgonura viridissma* (Linnaeus)], improper designation by: Latreille 1810, p. 433; Blanchard in Cuvier 1848, XI, p. 389; Girard 1879, p. 184.

Gryllus flavipes Gmelin [synonym of *Gryllus* (*Locusta*) *grossus* Linnaeus = *Stethophyma grossa* (Linnaeus)] improper designation by Westwood 1838, p. 45.

Locusta tatarica Linnaeus [= *Gryllus* (*Locusta*) *tataricus* Linnaeus, orig. comb. = *Cyrtacanthacris tatarica* (Linnaeus)], later designation by Krauss 1902, p. 541.

There is a report by Secretary Hemming of the International Commission on the results of a vote at the 1935 Lisbon Congress published in 1936.[36] In this report there are two Orthoptera names (*Locusta* and *Phaneroptera*) cited together with their genotypes as validated by the suspension of rules. Dr. Ashley B. Gurney has very kindly brought to my attention that this action by the Commission cannot be considered as proper or valid, since under the Plenary Powers granted to the Commission for suspension of rules, it states that not less than one year's notice shall be given in any two or more of certain specified journals for such an action in order to allow the specialists in the groups concerned to express their opinion. Since no year's notice had been given, this action cannot be taken as final and we must await another decision. The necessity for such an action on the name *Locusta* is apparently owing to Opinion 124, which considers the generic subdivisions of Linnaeus 1758 as having no status as of this date. For a discussion of this Opinion refer to the introductory portion of this paper where I have suggested that all genera of the Orthoptera as of Linnaeus 1758 be recognized in so far as the Opinion affects them, until we can obtain a specific opinion from the Commission concerning these names. Therefore it seems best to continue the use of the name *Locusta* as indicated above. For a previous discussion of this name see Uvarov 1921.[87]

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[84] Latreille, Règne Animal, p. 415, 1825.

[85] Latreille, Règne Animal (nouv. ed.), v, p. 188, 1829.

[36] XII Congr. Int. Zool., Comptes Rendus, I (1st part), p. 191, 1936.

Subfamily PAMPHAGINAE

Pamphagus Thunberg, Mém. Acad. Pétersb., v, pp 217 and 260, 1815.

TYPE: *Gryllus serripes* Fabricius [= *Gryllus* (*Locusta*) *serripes* Linnaeus, orig. comb. and authority = *Pamphagus* [or *Porthetis*?] *carinatus* (Linnaeus)], by first subsequent designation, Kirby 1890, p. 588.

Pamphagus elephas (Linnaeus) [= *Gryllus* (*Locusta*) *elephas* Linnaeus, orig. comb.], later designation by Kirby 1910, p. 352.

Kirby's earlier type designation would appear to make it necessary to apply this name to *Porthetis* Serville, 1831. Concerning the name, Dr. Uvarov (in litt.) expressed the following comment, "I cannot agree that Kirby in 1890 designated *G. serripes* as the type. He merely expressed an opinion that Burmeister has already done so by including *serripes* into *Pamphagus* as the only original species, 'which thus becomes the type,' obviously without reason. Kirby himself saw his mistake in 1910 when he formally designated *elephas* as the type of *Pamphagus*. If this is not strictly legal, the Commission should be asked to put *Pamphagus* on the official list, with *elephas* as type." Unfortunately as this designation may be, I can see no doubt as to its legality. Certainly the reasons for Kirby's selection of the type can have no bearing on the validity of the designation. Also since he was working on the system of elimination, as were most authors of that period, he naturally did not consider that he himself was responsible for this or any other designation in this paper. This is also probably true to a great extent in his later Synonymic Catalogue of the Orthoptera. However, until some final action is taken on the status of the name, it would be well to continue to apply the name to the genus containing *P. elephas*.

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[87] Uvarov, Bull. Ent. Research, XII, (2), p. 136, 1921.

Porthetis Serville, Ann. Sci. Nat., XXII, p. 270, 1831.

TYPE: *Porthetis dentata* (DeGeer) [= *Acrydium dentatum* DeGeer orig. comb. and synonym of *Pamphagus* [or *Porthetis?*] *carinatus* (Linnaeus)], by monotypy. Later designated by: Kirby 1890, p. 588; Kirby 1910, p. 346.

If the genus name *Pamphagus* is to be applied to this genus, then the name *Porthetis* will become a synonym by priority. See discussion under that genus above.

Subfamily CYRTACANTHACRIDINAE

Podisma Berthold, Latreille's Nat. Fam. Thier., p. 411, 1827.

TYPE: *Gryllus pedestris* Linnaeus [= *Gryllus* (*Locusta*) *pedestris* Linnaeus, orig. comb. = *Podisma pedestris* (Linnaeus)], by first subsequent designation, Westwood 1838, p. 45. Later designated by: Kirby 1890, p. 590; Scudder 1895, Psyche, VII, p. 196; Kirby 1910, p. 533.

Family TRIDACTYLIDAE

Tridactylus Olivier, Enc. Meth. Ins., IV, p. 26, 1789.

TYPE: *Tridactylus paradoxus* Latreille, 1802,[38] by reason of being first and only species included at this time. Later designated by Kirby 1890, p. 575.

Acheta digitata Coquebert, 1804 [synonym of *Tridactylus paradoxus* Latreille, 1802], designated by Latreille 1804, Hist. Nat. Crust. Ins., XII, p. 120, according to the International Commission, XII Congr. Int. Zool., Comptes Rendus, I (1st part), p. 190, 1936. Also designated by Kirby 1906, p. 7.

Xia variegata Illiger[89] [= *Xya variegata* Latreille, 1809, original authority, = *Tridactylus variegatus* (Latreille)], improper designation by Latreille 1810, p. 433.

I fail to see why *T. paradoxus* is not the valid genotype for this generic name. The International Commission (cited above) states that *Acheta digitata* is the proper genotype and designated by Latreille, 1804, according to the provisions of the Code. No indication is given why *T. paradoxus* Latreille, 1802, was ignored or not mentioned in their decision.

Family TETTIGONIIDAE[40]

Subfamily EPHIPPIGERINAE

Ephippiger Berthold, Latreille's Nat. Fam. Thier., p. 409, 1827.

TYPE: *Locusta ephippiger* Fabricius, 1787 [= *Ephippiger ephippiger* (Fiebig), 1784], by tautonomy and first single included species, Latreille 1829, Règne Animal, (nouv. ed.), v, p. 184. Later designated by: Westwood 1838, p. 45; Duponchel in d'Orbigny 1844, v, p. 352.

Berthold is the earliest authority for this name and not Latreille.

Ephippigera Serville, Ann. Sci. Nat., XXII, p. 165, 1831.

TYPE: *Ephippiger vitium* Serville, 1831 [new name proposed for *Locusta ephippiger* Fabricius, 1787 = *Ephippiger ephippiger* (Fiebig)], by tautonomy. Later designated by: Girard 1879, p. 173; Kirby 1890, p. 579.

This name is not strictly speaking an emandation of *Ephippiger*, but rather was derived independently from Latreille's vernacular name "Ephippigère" of 1825. However, since they are isogenotypic, Serville's name becomes an absolute synonym by priority.

Subfamily MECONEMATINAE *

Meconema Serville, Ann. Sci. Nat., XXII, p. 157, 1831.

TYPE: *Meconema varia* (Fabricius) [= *Locusta varia* Fabricius, 1775, orig. comb. and is synonym of *Meconema thalassinum* (DeGeer), 1773], by monotypy. Also designated by Westwood 1838, p. 45; Kirby 1890, p. 582; Kirby 1906, p. 370.

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[88] Latreille, Hist. Nat. Crust. Ins., III, p. 276, 1802.

[89] Latreille cites Illiger as the authority for the name. but this name would appear to be from a manuscript, though no such indication is given.

[40] The sequence of subfamilies of the *Tettigoniidae* is taken from Zeuner 1936, Proc. R. Ent. Soc. London, v, p. 108.

* The name *Meconema* is formed from μηκος + νημα. Therefore the name is neuter and the stem is meconemat—.

Subfamily PHASGONURINAE (= TETTIGONIINAE)[41]

Phasgonura Stephens, Brit. Ent., p. 15, 1835.

TYPE: *Phasgonura viridissima* (Linnaeus) [= *Gryllus* (*Tettigonia*) *viridissimus* Linnaeus, orig. comb.], by monotypy. Also designated by: Westwood 1838, p. 45; Kirby 1890, p. 582; Kirby 1906, p. 216.

The name *Tettigonia* Linnaeus has recently been applied to this genus, but this is an improper application of the name, as discussed below.

Subfamily TETTIGONIINAE (= DECTICINAE)[41]

Tettigonia Linnaeus, Syst. Nat., (ed. X), I, 429, 1758.

TYPE: *Gryllus verrucivorus* Linnaeus [= *Gryllus* (*Tettigonia*) *verrucivorus* Linnaeus, orig. comb. = *Tettigonia verrucivora* Linnaeus], by first subsequent designation, Kirby 1890, p. 581. Later designated by Kirby 1906, p. 212.

Tettigonia viridissima Linnaeus [= *Phasgonura viridissima* (Linnaeus)], later designated by Rehn 1901, Canadian Ent., XXXIII, p. 121.

Tettigonia acuminata Linnaeus [= *Oxyprora acuminata* (Linnaeus)], later designation by Krauss 1902, p. 541.

The application of this name has had an involved history and has been the subject of much controversy. First proposed by Linnaeus, 1758, as a subgenus in the Orthoptera, it was soon after applied to certain Homoptera by Geoffroy, 1762. Then Kirby, 1890 and 1906, applied it to the genus *Decticus*. Rehn, 1901, proposed its application to *Phasgonura*. Krauss, 1902, applied it to *Oxyprora*. Uvarov, 1923,[42] and Karny, 1925,[43] contended that Leach, 1815,[44] had made the first proper type designation for *Tettigonia*, which was *T. viridissima*. This was the same species designated by Rehn, 1901. It now appears that there was no proper genotype designation by Leach 1815, according to the present system of the International Code, so that Kirby's 1890 designation is the first valid one. Thus the name should be properly applied to *Decticus* of the subfamily *Decticinae* of recent authors and not *Phasgonura* of the subfamily *Phasgonurinae* (or *Tettigoniinae* of recent authors). *Decticus,* as shown below, falls as a synonym by priority. This shift in names is unfortunate, but in my opinion decidedly preferable than attempting to retain it for *Phasgonura* by asking the Commission for a purely arbitrary suspension of rules.

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[41] If as suggested below the genus name *Tettigonia* is to be recognized as of Linnaeus 1758 and properly applied, then the name no longer remains within the subfamily usually called *Tettigoniinae* and hence this subfamily name may no longer be used for the group. *Phasgonurinae* would appear to be the next preferable name to replace it. Since *Tettigonia* applies to the genus called *Decticus* by recent authors and the latter name becomes a synonym, the subfamily name *Decticinae* may no longer be used, *Tettigoniinae* would be the proper name. This is an unfortunate mix up, but there appears to be some doubt whether these two subfamilies are actually separable, and if they are combined to form one subfamily, this will simplify the nomenclature as *Tettigoniinae* may be used for the combined groups.

[42] Uvarov, Trans. Ent. Soc. London, p. 493, 1923.

[43] Karny, Treubia, VI, p. 445, 1925. See also Karny, Zool. Annalen, II, pp. 202–208, 1908.

[44] Leach, Edinburgh Encyclopedia, p. 120.

Aside from the proper application of *Tettigonia,* according to Opinion 124 this name as well as all other generic subdivisions of Linnaeus 1758 are considered to have no status as of that date. For a discussion of this Opinion refer to the introductory portion of this paper. There I have suggested that all subgenera of the Orthoptera as of Linnaeus 1758 be recognized in so far as this Opinion affects them, until we can obtain a specific opinion from the Commission concerning these names.

Decticus Serville, Ann. Sci. Nat., XXII, p. 155, 1831.

TYPE: *Gryllus verrucivorus* Linnaeus [= *Gryllus* (*Tettigonia*) *verrucivorus* Linnaeus, orig. comb., = *Tettigonia verrucivora* Linnaeus], by first subsequent designation, Westwood 1838, p. 45. Later designated by: Girard 1879, p. 190; Kirby 1890, p. 581.

Decticus falls as an absolute synonym of *Tettigonia* by priority, as discussed above under the latter name.

Subfamily CONOCEPHALINAE

Xiphidion Serville, Ann. Sci. Nat., XXII, p. 159, 1831.

TYPE: *Locusta fusca* Fabricius, 1793 [synonym of *Conocephalus discolor* Thunberg, 1815 [45]], by first subsequent designation, Westwood 1838, p. 45. Later designated by: Duponchel in d'Orbigny 1849, XIII, p. 317; Kirby 1890, p. —.

This genus is considered congeneric with *Conocephalus* Thunberg, 1815, and *Xiphidion* becomes a synonym by priority. However, Karny, 1912,[46] restricts the name to a subgenus of *Conocephalus.*

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[45] The name *Locusta fusca* Fabricius, 1793, is preoccupied by *Gryllus* (*Locusta*) *fusca* Pallas, 1773, and the next name available for the former species appears to be *Conocephalus discolor* Thunberg, 1815, Mém. Acad. St.-Pétersb., V, p. 275, since Kirby 1906 and Karny 1912 considered this species of Thunberg as a synonym of *Locusta fusca* Fabricius.

Subfamily PHANEROPTERINAE

Phaneroptera Serville, Ann. Sci. Nat., XXII, p. 158, 1831.

TYPE: *Phaneroptera lilifolia* (Fabricius) [= *Locusta lilifolia* Fabricius, orig. comb. and synonym of *Phaneroptera thymifolia* (Petagna)], by first subsequent designation, Blanchard in d'Orbigny 1848, vol. XI, p. 392.

Locusta curvicauda DeGeer [= *Scudderia curvicauda* (DeGeer)], later designated by Caudell 1921, Journ. Wash. Acad. Sci., II, p. 487.

Gryllus falcatus Poda [= *Anerota falcata* (Poda)], improper designation by: Girard 1879, p. 179; Kirby 1906, p. 434.

The above type designation of Blanchard has not been noted in the literature by subsequent authors. This designation makes *Phaneroptera* apply to the genus known as *Tylopsis* Fieber, the latter name falling as a synonym by priority. Caudell, cited above, designated *Locusta curvicauda* as the type of *Phaneroptera* evidently unaware of Blanchard's designation and because he correctly considered Kirby's designation of *Gryllus falcatus* as improper, since it was not an originally included name in the genus *Phaneroptera.* This designation of Caudell would make *Phaneroptera* apply to the American genus *Scudderia* and he proposed the name *Anerota* for *Phaneroptera* as applied by recent authors with *Gryllus falcatus* as type. Since Blanchard's earlier designation now would make *Phaneroptera* apply to *Tylopsis* instead of *Scudderia,* the genus called *Phaneroptera* by Kirby and later authors has *Anerota* Caudell available for it. However, an application has been made to the International Commission for suspension of rules to make *Gryllus falcatus* Poda as the type of *Phaneroptera* and it is therefore perhaps better to follow recent usage of the names and to await a final decision by the Commission. Such a decision was published by the Commission in 1936, but this is not considered proper or valid, the reasons for which are discussed under the name *Locusta* in the *Oedipodinae.*

The cause of difficulty with this generic name has been due to the fact that though Serville had the specimens of *G. falcatus* before him when he proposed this genus, he called them mistakenly by another name and did not originally include their correct name within the genus. Therefore this name is not properly available as the genotype. Kirby and other authors had not considered or disregarded this aspect of the case. Caudell, cited above, was the first to point this out and proposed a different application of the name. Now with the recognition of Blanchard's earlier type designation, the aspects of the case are altered again.

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[46] Karny, Genera Insectorum, Fasc. 135, p. 10, 1912.

Pennicornu Berthold, Latreille's Fam. Nat. Thier., p. 408, 1827.

TYPE: *Scaphura vigorsii* Kirby, 1825 [synonym of *Scaphura nigra* (Thunberg), 1824], type by present designation.

This generic name of Berthold has never had any species included in it, but by the above type designation it becomes an absolute synonym of *Scaphura* Kirby, 1825.

Family GRYLLIDAE

Subfamily GRYLLINAE

Gryllus Linnaeus, Syst. Nat., (ed. X), I, p. 425, 1758.

TYPE: *Acheta campestris* Fabricius, 1775 [= *Gryllus* (*Acheta*) *campestris* Linnaeus, 1758, orig. comb. and authority = *Gryllus campestris* Linnaeus], by first subsequent designation, Latreille 1810, p. 433.

Gryllus (*Acheta*) *domesticus* Linnaeus [= *Acheta domestica* Linnaeus], later designation by: Kirby 1890, p. 576; Rehn 1901, Canadian Ent., XXXIII, p. 120; Rehn 1904, Proc. Acad. Nat. Sci. Phila., p. 546; Kirby 1906, p. 27.

The International Commission has placed *Gryllus* on the Official List with *A. campestris* as genotype in Opinion 104, (1908).

Acheta Linnaeus, Syst. Nat., (ed. X), I, p. 428, 1758.

TYPE: *Gryllus domesticus* Linnaeus [= *Gryllus* (*Acheta*) *domesticus* Linnaeus, orig. comb., = *Acheta domestica* Linnaeus], by first subsequent designation, Curtis 1830, VII, p. 293. Later designated by: Westwood 1838, p. 44; Rehn 1901, Canadian Ent., XXXIII, p. 120; Krauss 1902, p. 542.

Gryllus (*Acheta*) *campestris* Linnaeus [= *Gryllus campestris* Linnaeus], later designation by: Kirby 1890, p. 574; Kirby 1906, p. 24.

The name *Gryllulus* was proposed by Uvarov in 1935[47] to replace *Gryllus* as improperly applied by recent authors and with the genotype *G. domesticus,* the proper genotype of *Gryllus* being *G. campestris.* It now appears that *Acheta* is an available name for the genus named *Gryllulus* by Uvarov. One reason that authors have not used the name *Acheta* perhaps is that they considered it an absolute synonym (based on same genotype) of the name

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[47] Uvarov, Ann. Mag. Nat. Hist., Ser. 10, XVI, (92), p. 320.

Gryllus. Linnaeus had six subgeneric (or subdivisions) names under the large inclusive genus *Gryllus,* but there was no subgenus named *Gryllus.* According to the Code, one of the subgenera of *Gryllus* should also bear this name. Now all of these subgeneric names were potentially valid until Latreille first designated a genotype for *Gryllus,* which then made *Acheta* a synonym of *Gryllus,* since the genotype of *Gryllus* was at that time congeneric with the species included by *Acheta.* However, I can find no reason or precedent to assume that *Acheta* became an absolute synonym of *Gryllus* by this designation of Latreille. Now when Curtis, who made the first type designation for *Acheta,* designated a different species as genotype than the genotype of *Gryllus, Acheta* became a potentially valid name, but still remained a synonym of *Gryllus* so long as the two species or genotypes were considered as congeneric. At present, however, *G. domesticus,* the type of *Acheta,* is not considered congeneric with *G. campestris,* the type of *Gryllus,* and therefore *Acheta* is certainly available for the genus which includes *G. domesticus.* It would therefore appear that *Gryllulus* Uvarov becomes an absolute synonym of *Acheta* by priority.

Aside from this aspect of the problem, according to Opinion 124 this name as well as all other generic subdivisions of Linnaeus 1758 are considered to have no status as of this date. For a discussion of this Opinion refer to the introductory portion of this paper. It is there suggested that all subgenera of the Orthoptera as of Linnaeus 1758 be recognized in so far as this Opinion affects them until we can obtain a specific opinion from the Commission concerning these names. As far as *Acheta* is concerned with this Opinion it is simply whether the authority shall be Linnaeus 1758 or some subsequent authority.

Family GRYLLOTALPIDAE

Gryllotalpa Latreille, Hist. Nat. Crust. Ins., III, p. 275, 1802.

TYPE: *Gryllus* (*Acheta*) *gryllotalpa* Linnaeus [= *Gryllotalpa gryllotalpa* (Linnaeus)], by tautonomy and monotypy. Later designated by: Latreille 1810, p. 433; Curtis 1833, no. 456; Kirby 1890, p. 575; Krauss 1902, p. 542.

Gryllus vulgaris Latreille, 1804 [synonym of *Gryllus* (*Acheta*) *gryllotalpa* Linnaeus, 1758 = *Gryllotalpa gryllotalpa*], later designation by Westwood 1839, p. 44.

DESCRIPTIONS AND RECORDS OF NORTH AMERICAN TRICHOPTERA

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(Plates I–XIII)

Study of additional caddis fly material from many parts of North America has resulted in the recognition of many new forms, descriptions of which appear in this paper. Much of this material has been sent in for identification by limnologists and others interested in aquatic insects, and quite a large amount has been collected by fellow members of the Natural History Survey. Since many of these names have been requested by others for faunistic and ecological studies, the species are being described to make their names available.

Recently, also, the Academy of Natural Sciences of Philadelphia [ANSP] sent me their caddis fly material for identification, and this entire collection of some 1000 larval and adult specimens has been recorded herein. Only those species have been mentioned which can be identified to species and which bear locality data; many of the larvae and female specimens can be identified only to genus at the present time. Many of these records are of exceptional interest. Others are of common and widespread species. So few definite records of Trichoptera have been published, however, since recent re-definition of many species that all such locality citations are valuable. Of great historic interest are many of the older labels which, although lacking spot locality, yet contribute a good insight into the breadth of collecting by some of the earlier entomologists.

Unless otherwise stated, the types of all the new forms here described are in the collection of the Illinois Natural History Survey [INHS].

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I wish to express my appreciation and gratitude for their cooperation to Dr. T. H. Frison, Chief, Illinois Natural History Survey; Dr. B. D. Burks and Mr. G. T. Riegel, also of the Natural History Survey; Professor P. W. Fattig, Emory University, Emory University, Georgia; Professor W. C. Stehr, Ohio University, Athens, Ohio; Mr. J. N. Knull, Ohio State University, Columbus, Ohio; the late Mrs. Vitae Kite, Hollister, Missouri; and to many others. To Mr. E. T. Cresson, Jr., I am greatly indebted for making available to me for study, the Academy collection. To Dr. C. O. Mohr, of the Illinois Natural History Survey, I wish to express my deep appreciation for help with the illustrations.

Family RHYACOPHILIDAE

Rhyacophila acropedes Banks

This species has previously been considered as restricted to the Rocky Mountain region. In view of this the following record is of great significance.

LABRADOR: July 17, 1912 (H. C. Bryant), 1 ♂, [ANSP].

Rhyacophila blarina new species (Pl. I, fig. 1.)

The two species *minora* Banks and *manistee* Ross are both closely related to this new one which differs from them, however, in the sharp, lateral angles and the high, mesal ridge of the tenth tergite, besides other differences in the claspers and aedeagus.

Male. Length 10 mm. Color dark brown, the legs below coxae slightly paler than the body, the wings practically without markings of any description. General structure typical for genus, the diagnostic characters apparently confined to the genitalia.

Genitalia as in figure 1. Ninth segment cylindrical, narrower ventrad than dorsad. Tenth tergite, seen from above, quadrate with a narrow, produced tongue which is immarginate at apex; seen from the side, it is somewhat shelf-like, the lateral margins are produced into a sharp corner, the dorsum is produced into a high ridge and the apex is narrowed into a snout; beneath, it is concave. Claspers with an apical segment approximately half the length of the basal one, the base of it somewhat parallel-sided and the apico-dorsal corner excavated so that the ventral portion is produced; basal segment also more or less parallel-sided; neither segment has pattern-forming patches of black, appressed setulae. Aedeagus composed of (1) a short, barrel-shaped base, (2) a dorsal, beak-like complex with an upturned, slender tube at apex, and (3) an extensile, ventral trunk bearing at its apex a semimembranous, spoon-like body which is wrinkled longitudinally on the basal portion, bears a concave, dorsal pocket and on one side of this pocket a long brush of pale, slender, and closely packed setae.

Female. Length 10.5 mm. Color and general structure same as for male. Genitalia simple, eighth segment tubular, relatively stocky and tapering from base to apex.

Holotype.—Male; Clatskanie, Oregon; May 9, 1936; (K. Gray and Schuh).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—5 ♂, 12 ♀; same data as for holotype. 1 ♂; along Oak Creek, five miles northwest of Corvalis, Oregon; April 29, 1937.

Series of paratypes are placed in the collections of the Oregon Agricultural College and in The Academy of Natural Sciences of Philadelphia.

Rhyacophila ecosa new species (Pl. I, fig. 2.)

This species is most closely related to the *invaria* group but may be separated from them by the very long projection of the ninth segment over the tenth and the funnel-shaped sclerite at the apex of the production.

Male. Length 8.5 mm. Color medium brown, the legs below coxae and antennae shading to tawny. General structure typical for genus. Genitalia as in figure 2. Ninth segment annular, the dorsum markedly sloping and produced into a long, tongue-like and bifid projection. Beyond and below this are situated the three principal sclerites making up the tenth tergite: (1) a short, wide, funnel-like sclerite at the apex of the "tongue"; (2) a pair of lateral sclerites rounded above, produced into a short projection on the postero-ventral corner and aligned directly beneath the tongue; and (3) a pair of more or less finger-like mesal plates with reticulated apical surface, alined beneath and projecting slightly beyond the funnel. Claspers with basal segment long, twice as long as wide, slightly curved, and clothed with scattered setae; apical segment only half as long as the first, its dorsal margin arcuate and bearing a mesal brush of peg-like, stout setae. Aedeagus very small, consisting of an extensile, membranous, basal portion from which projects a sclerotized, tubular hook, narrowed and slightly upturned at apex, large and bulbous at base, and with a sclerotized point projecting from the base dorsad of the apical tube.

Holotype.—Male; near creek, Boyer, Oregon; May 6, 1934; (M. L. H.).*

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* This is apparently an abbreviation of the collector's name, which the author has been unable to ascertain.

Rhyacophila fuscula (Walker)

This is the *Rhyacophila* most frequently met in the Appalachian region.

NEW YORK: Ringwood; April 30, 1937, 5 larvae, [ANSP].

PENNSYLVANIA: Marshall's Creek, Monroe Co.; May 24, 1935, (W. J. Harmer), 1 larva, [ANSP]. Swiftwater, Monroe Co.; (F. R. Nevin; 1928), 2♂, [ANSP].

Rhyacophila invaria Walker

Few specimens of this interesting species have been recorded in the literature.

PENNSYLVANIA: Swiftwater, Monroe Co.; (F. R. Nevin; 1928), 1♂, [ANSP].

Rhyacophila mycta new species (Pl. I, fig. 3.)

This species is most closely related to *nigrita* Banks, but differs in the round, dorsal lobes of the tenth tergite, and the produced and conspicuous reticulate median lobes of the same segment.

Male. Length 11 mm. Color various shades of gray mingled along the sutures and on many parts of the legs with greenish; wings dark, the apical half of the front pair with inconspicuous fenestrations which form a close pattern. General structure typical for genus, including wing venation, spur count, etc.

Genitalia as in figure 3. Ninth segment annular, the dorsal margin produced at apex into an overhanging lobe which is deeply emarginate on the meson to form a pair of well delineated, lateral lobes. Tenth tergite short, with a wide basal portion which merges with a high, dorsal lobe. This lobe is convex laterally, studded with setae on both inner and outer margins and is evenly rounded on top. The mesal, reticulate lobe projects from the lower portion of the tergite; they are ovoid and divergent. Claspers with basal segment oblique, about as wide as dorsal length; apical segment shoe-shaped, as in fig. —, with a few scattered setae on heel and toe and with a brush of short, heavy, black spines on the mesal surface. Aedeagus short, consisting of a tubular, membranous, basal portion and an extrusible unit consisting of a sclerotized vertical plate hooked up into a beak at the bottom and produced at each dorsal corner into a small ear-like lobe; beneath this are two short, membranous pads and at each side a small, saber-like, sclerotized blade.

Holotype.—Male; Clingmans Dome, 6400 feet elevation, Great Smoky Mountain National Park, North Carolina; June 18, 1937; (C. P. Alexander).

Paratypes.—1♂; same data as for holotype; [INHS]. 1♂; Silers Trail, 6000 feet elevation, Great Smoky Mountain National

Park, North Carolina; June 9, 1939; (C. P. Alexander); [Mass. Agric. College].

Rhyacophila nigrita Banks

This species is known to occur from Ontario to Georgia throughout the mountainous region.

PENNSYLVANIA: Swiftwater, Monroe Co.; (F. R. Nevin; 1928), 1 ♂, 1 ♀, [ANSP].

Rhyacophila norcuta Ross

1938. *Rhyacophila norcuta* Ross, Proc. Ent. Soc. Wash., XL (5): p. 118. May 29.*

1938. *Rhyacophila novarotunda* Ling, Pan-Pacific Ent., 14 (2): p. 61. June 11.* (New synonymy.)

Records in the above descriptions indicate that this species is restricted to the more western ranges of the Pacific Coast region.

W[ASHINGTON] T[ERRITORY]: 2 ♂, [ANSP].

Rhyacophila oreta new species (Pl. I, fig. 4.)

This species is closely related to *basalis* Banks, differing from it in the arcuate curve of the aedeagus, and the lateral process of the aedeagus, notably its apical, diagonal ridge of dark, appressed scales.

Male. Length 10 mm. Color of head and body dark brown, the antennae, mouthparts, and legs below coxae, light brown to tawny, the wings uniformly dark brown. General structure typical for genus, including wing venation and legs. Maxillary palpi with third segment longest, fourth and fifth subequal to each other and markedly shorter than third.

Genitalia as in figure 4. Ninth segment with ventral portion very narrow, lateral expanse widest, and dorsum declivous. Tenth tergite large, the dorsal aspect narrow and rectangular, the lateral aspect deep, the dorsal margin evenly convex and the central margin evenly rounded. The extreme apex is produced into a pair of small, rounded lobes. Claspers with basal segment almost three times as long as apical segment, narrow and slightly wider near apex; apical segment more or less triangular, the apical margin slightly incised, the dorsal angle fairly sharp, the ventral angle rounded. Aedeagus with a short, stout, basal portion, the ventral side of which is produced into a long, stout, almost evenly rounded, upturned process; at the base of the aedeagus arises a ventral pair of extensile, membranous arms tipped with a sclerotized blade which bears on the inner face an apical, diagonal, linear brush of flattened appressed hair, the apical and ventral margins bear apical long setae which form an inconspicuous brush; there is no vestiture on the dorsal margin.

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* These dates represent actual date of publication as nearly as can be determined; this is different from the sequential month in the case of the second article.

Female. Size, color, and general structure as for male. Genitalia simple, seventh and eighth segments annular and tapering, ninth and tenth membranous and typical for genus.

Holotype.—Male; Scout Camp, Logan Canyon, Utah; April 17, 1938; (D. E. Hardy).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—1 ♂; same data as for holotype; [INHS]. 1 ♂; Big Cottonwood Canyon, Utah; April 24, 1937; (G. F. Knowlton & F. C. Harmston); [ANSP]. 1 ♂; Troutdale, Multnomah Co., Oregon; April 15, 1939; (S. G. Jewett, Jr.); [INHS].

Rhyacophila phryganea new species (Pl. I, fig. 5.)

The large size and conspicuous mottled wings give this species a startling resemblance to certain males of the family Phryganeidae. In the genus *Rhyacophila* this species resembles *vedra* Milne as closely as any but differs markedly from this and all others in the large, spinose tenth tergite.

Male. Length 25 mm. Head, body, and appendages reddish-brown, with the following exceptions: front wings a mixture of light and dark brown in a salt and pepper combination and when viewed under several diameter's magnification, finely irrorate over the entire surface. Viewed with a naked eye, the front wings assume a definite pattern of chocolate-brown spots separated by light brown areas; there are four of these dark brown bands in the cubital region between the base of the wing and the apex of Cu_2. On the anterior and apical margins are a series of more or less evenly spaced chocolate-brown spots, those on the apical margin coinciding with the end of each vein. In the central portion of the wing, there is a medium sized, lunate, dark area centering around the radio-medial crossvein, beyond this an irregular, somewhat silvered band, and beyond this again a larger lunate dark brown area. Hind wings slightly smoky. Front and middle tibiae each with two straw-colored and two dark brown bands, all the bands of equal color with a light one at the base, a dark one beyond it, a light one beyond it, and a dark one at the apex.

General structure typical for genus. The large size is extremely unusual. Venation, antennae, ocelli, spur count, etc., typical for genus. Sixth and seventh sternites each with a very small mesal tooth on the apex of the sclerotized ridge running along the apical portion of the segments.

Genitalia as in figure 5. Ninth segment cylindrical and forming an almost uniform band over its whole circumference. Tenth tergite attached to the ninth with a definite visible point of articulation; it is divided to the base into a pair of large lobes with a high, spinose ridge running along the entire apical and dorsal margins and with the ventro-lateral margin sinuate; within these two lobes are a pair of small, sclerotized spinose processes. Claspers with a large but narrow foot-like base, the base with a wide mesal extension; from this base angles off the attenuated portion of the basal segment, this portion being constricted at base and wide and somewhat foliaceous towards apex; second segment very short, with the base nearly as broad as the apex of the first segment, the apico-dorsal margin concave so that the apex is narrowed and rounded. Aedeagus short, composed of a stocky, membranous base from which projects two short, lateral, membranous folds, each bearing a short, stout, spinose, extensile rod, and from between these lobes there extends a mesal sclerotized rod which is divided at the apex into a lower, narrow, setose process and an upper, large spatulate process.

Holotype.—Male; Horsetail Falls, Oregon; April 18, 1940; (S. G. Jewett, Jr.).

Paratypes.—1 ♂; California "Cala." 4 ♂; same data as for holotype.

Paratypes are in the collections of the Illinois Natural History Survey, S. G. Jewett, Jr., and The Academy of Natural Sciences of Philadelphia.

Glossosoma idaho new species (Pl. I, fig. 6.)

This species belongs to the group of the genus in which the genitalia are partially enclosed by hood-like folds of the ninth segment. It is most closely related to *parvula* Banks, but can be distinguished from it by the lack of sclerotized rods originating in the aedeagus and extending over the base of the claspers and also in the shape of the aedeagus.

Male. Length 6.5 mm. Color very dark brown, the legs below coxae paler. Structure typical for related members of the genus. Fifth sternite with lateral auriculate lobes; sixth and seventh sternites without processes. Diagnostic characters apparently confined to the male genitalia.

Genitalia as in figure 6. Caudal extensions of ninth segment triangular, the dorsal margin slightly sinuate and the apex pointed, extending beyond the apex of the tenth. Tenth tergite merging with ninth, with no perceptible basal suture between them; its apical portion is broad, narrowing rapidly to a somewhat rounded tip with a sharp point situated just above the rounded caudo-ventral shoulder, the dorsal portion at apex bearing a few short, scattered setae; cerci somewhat boot-shaped, the apex truncate and bearing scattered, medium-length setae, the base with a dorsal hump bearing a long spine. Claspers with the base small, rounded, tapering suddenly to an elongate apical portion which bears an irregular row of setae along the meso-dorsal line. Aedeagus composed of a tubular dorsal portion and a ventral portion divided into a pair of membranous blades which project above the base of the claspers and reach over half way to their apex. The tubular part of the aedeagus appears cylindrical from side view with the apex enlarged slightly and forming irregular membranous folds, and more or less elliptic from ventral view.

Holotype.—Male; Hagerman, Idaho; September 18, 1939; (Knowlton & Harmston).

Glossosoma montana new species (Pl. I, fig. 7.)

A close relative of *parvula* Banks, this species may be distinguished from it by the lack of sclerotized rods originating at the base of the aedeagus and extending over the base of the claspers and also in the shape of the aedeagus. It is related, also, to *idaho* Ross, but differs from it in the presence of mesal processes on the sixth and seventh sternites, the longer spine, the base of the cerci, and the wider base of the clasper.

Male. 7.0 mm. Color dark brown, the legs below coxae paler. Structure typical for related members of the genus. Fifth sternite with lateral auriculate lobes; sixth and seventh sternites each with an apico-mesal, flat, rounded process.

Genitalia as in figure 7. Caudal extension of ninth segment with dorsal margin sinuate, apex more or less rounded and ventral margin arcuate. Tenth tergite merging with ninth with no perceptible basal suture between them; its apical portion narrows rapidly to a somewhat rounded tip with a short point situated at apex; cerci boot-shaped, the apex rounded and bearing scattered setae, the base with a dorsal hump bearing a long, curved spine. Claspers with base large and conspicuously shouldered, the apical portion elongate, almost parallel-sided, and clothed with an irregular row of setae along the meso-dorsal line. Aedeagus short, composed of a tubular dorsal portion and a ventral portion divided into a pair of membranous blades which project scarcely beyond the base of the claspers.

Holotype.—Male; along Missouri River, Toston, Montana; June 22, 1940; (H. H. & J. A. Ross).

Paratypes.—10 ♂; same data as for holotype.

Series of paratypes are in the collections of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Glossosoma pyroxum new species (Pl. I, fig. 8.)

This species is closely related to *alascensis* Banks from which it differs in the shorter, head-like projections of the ninth segment, the beaked tenth tergite and the much shorter and stouter lateral appendage of the tenth tergite.

Male. Length 8 mm. Color and general structure identical with the preceding species. Diagnostic characters confined to the genitalia.

Genitalia as in figure 8. Ninth segment with the lateral margins produced into flaps forming a hood-like covering for the rest of the genitalia. Ninth tergite confluent with the tenth. This latter is represented by a pair of sclerotized bands, sinuate in outline, with the apex forming a short, but very distinct beak and the surface covered with short stout setae which are more button-like than hair-like. Near the confluence of the ninth and tenth tergites arises a whip-like structure which seems to be the surface; it is sinuate and twisted at the base, developing into a triangular portion and from that continuing in an upturned, whip-like crease to the apex which is slightly enlarged, bears a few stout lateral setae and a long stout spine at the apex. Claspers with dorsal surface slightly concave, ventral margin markedly convex, the entire structure flat and bladelike with the apical two-thirds clothed with long, scattered setae. Aedeagus long and simple, composed of a slender, sinuate, mesal tube and a short, ventral projection which extends between the bases of the claspers.

Holotype.—Male; Alsea Fish Hatchery, Benton County, Oregon; January 24, 1938; (S. G. Jewett, Jr.).

Agapetus vireo new species (Pl. I, fig. 10; pl. II, fig. 11.)

This species is most closely related to *artesus* Ross, differing in the quadrate and heavily sclerotized lateral plates which constitute the sclerotized portion of the tenth tergite.

Male. Length 4.6 mm. Color dark brown, the mouthparts and legs below coxae tawny, the wings uniform dark brown to black, typical for genus. General structure typical for genus, including venation, spur count, lateral bulbous organ of the fifth sternite, and mesal projection of the sixth sternite.

Genitalia as in figure 10. Ninth segment annular, only slightly narrower across the top than across the ventral portions. The tenth tergite composed of a pair of lateral, sclerotized, more or less quadrate plates, each one with a heavily sclerotized area along the caudal and ventral margins, with the apico-dorsal margin produced into a short, sharp point, preceded along the dorsal margin by a slightly serrate area; the area between these two lateral plates is occupied by membranous folds. Cerci short, and rounded with a dense brush of long setae pointed dorsad on the dorsal portion of the cerci. Claspers only slightly longer than the tenth tergite, slightly more than twice as long as high, the upper and lower margins almost straight, the apical margin rounded; from ventral view, they appear somewhat triangular but robust; the mesal side of the apical margin contains a sclerotized point at dorsal angle and a row of diminishing sclerotized points along the ventral angle. Aedeagus tapering and submembranous, simple, similar to that of other species in the genus.

Female. Similar in size, color, and structure to male, differing in the usual antigenetic characters. Genitalia as in figure 11. Seventh segment unmodified. Eighth segment with the dorso-lateral margins deeply incised to form a dorso-mesal, tongue-like flap; the apical margin is reflexed and produced so that the ninth segment is attached to it at about the same level as the basal margin of the segment. Ninth segment composed of an extensile, membranous, basal portion attached on a level with the base of the eighth, and with a wide, rod-like, sclerotized structure extending across the dorsum at the base and along the sides to the apex; to the base of this rod is attached a long, sclerotized, slender rod which extends anteriorly to the sixth segment. Tenth tergite with lateral sclerotized plates and with a pair of two-segmented, style-like organs which are presumably the cerci.

Holotype.—Male, Swamp Creek, seven miles south of Dalton, Georgia; May 25, 1931; (P. W. Fattig).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—3 ♀; same data as for allotype. 3 ♂, 3 ♀; West of Ozone, Tennessee; May 15, 1939; (Frison & Ross).

Paratypes are in the collections of the Illinois Natural History Survey and of The Academy of Natural Sciences of Philadelphia.

Agapetus tomus new species (Pl. I, fig. 9.)

In many respects, the genitalic structure of this species is the most distinctive in the entire genus. It is probably closest to *vireo,* but differs from it and its allies in the caudo-ventral knob of the tenth tergite and the wide, long claspers.

Male. Length 5.5 mm. Color and general structure identical with the preceding. Diagnostic differences apparently confined to the genitalia.

Genitalia as in figure 9. Ninth segment annular and long, reduced to a narrow strap on the dorsal margin. Tenth tergite consisting of a pair of lateral, sclerotized plates which are narrow at base, becoming wider towards apex, bear a lateral tooth near the middle of the ventral margin, a sharp sclerotized point on the apico-dorsal margin, are produced into a rounded "snout," and have a ventral band more heavily sclerotized than the remainder; between these two lateral plates are a series of membranous folds which become definitely semisclerotized and even where they join with the ninth segment. Cerci rounded at apex, moderately narrow and with a brush of hair directly laterad. Claspers wide and long, apical margin emarginate, dorsal and ventral corners produced into a sharp but short point, inner face concave, ventro-mesal margin slightly sinuate; the two in repose form a scoop-like sheath into which the tenth tergite fits and is hidden completely. Aedeagus simple, tubular, and apparently identical with other members of the genus.

Holotype.—Male; Swamp Creek, seven miles south of Dalton, Georgia; May 25, 1931; (P. W. Fattig).

Paratypes.—1 ♂; same data as for holotype; [INHS].

Protoptila balmorhea new species (Pl. II, fig. 12.)

This curious species is most closely related to the Mexican species *ixtala* Mosely and *resolda.* It may be distinguished from these two and other species of the genus by the curious meso-dorsal appendage of the ninth tergite.

Male. Length 3.0 mm. Color and general structure identical with related members of the genus, as tabulated in the accompanying key. Diagnostic characters apparently confined to the male genitalia. Male genitalia as in figure 12. Eighth segment aligned on a diagonal plan; its tergite bears a meso-dorsal appendage arising from a mesal incision, the base of the appendage circular and stock-like, bearing at its apex two short, dorsal spurs, and two long, sclerotized, sturdy spines which are subequal to the length of the stock itself and which extend ventro-caudad as far as the aedeagus; apico-lateral portion of tergite produced into a pointed triangle; eighth sternite produced into a long, spatulate lobe clothed with scattered long setae. Ninth segment somewhat U-shaped and retracted within eighth. Tenth tergite divided into lateral plates, each one divided by a crease or suture into a short, stocky, basal part and a curved apical part longer than the base, bearing a few scattered setae and with the apex divided into three digitate, sclerotized points. Aedeagus with an ovoid, fin-like, dorsal plate arising from the base with the upturned, ventral, hook-like bodies, with the tubular portion constricted near middle and the apex expanded into a large ovoid mass; there are no extensile lateral appendages arising from the base of this structure as in the preceding species.

Female. Length 3.2 mm. Similar in size, color, and general structure to male. Female genitalia simple. Internal processes consisting of a sclerotized, sinuate thread, arising from the apex of the eighth sternite, and following the ventral margin almost to the sixth segment; above this is a large, quadrate plate extending into the seventh segment and perforated near anterior margin by a relatively long, wide slit.

Holotype.—Male; Balmorhea, Texas; April 19, 1939; (H. H. & J. A. Ross).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—Texas. 15 ♂, 1 ♀; same data as for holotype.

Paratypes are in the collection of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Protoptila coloma new species (Pl. II, fig. 13.)

This species is closely related to *tenebrosa* (Walker), but differs in the much shorter production of the eighth sternite, the wider incision in its apex, and other details of the genitalia. The aedeagus follows the general pattern of *erotica* Ross and is suggestive that *erotica* is very similar to the ancestor of the *tenebrosa* group.

Male. Length 3 mm. Color typical for genus, the head, thorax, and abdomen dark brown, the entire body and appendages covered with dark setae, the wings with a transverse pale line running across at the cord General structure typical for genus, the head robust, the lateral ocelli situated on the suture and removed some distance from the eye. Scape twice as long as pedicel, thickest near middle, tapering at both ends; pedicel as long as third segment but considerably thicker. Thorax and abdomen typical for genus. Wings and venation typical for genus, the hind wings rather abruptly narrowed beyond hamuli, with a resultant saber-like outline. Spur count of legs 0–4–4, the spurs relatively short and the pre-apical pair situated two-thirds distance from base of tibiae.

Male genitalia as in figure 13. Eighth tergite slightly more heavily sclerotized than seventh, semiannular in shape. Eighth sternite produced ventrally into a broad scoop-like structure with a wide emargination at the apex; the lateral margins near apex clothed along the inside with a thick brush of spindle-shaped setae; dorso-caudal angle of this sclerite produced into a thumb-like piece also bearing a thick brush of spindle-like setae. Ninth segment represented by a shell-like genital capsule, retracted for the most part within the body cavity and incised deeply both dorsally and ventrally to form wide lateral plates. Tenth tergite divided down the middle almost to its base, the basal portions submembranous, the apical portion consisting of a somewhat quadrate lateral piece bearing a few scattered setae on the outer margin and ventro-caudal spine on the inner corner. Claspers apparently fused with each other and the genital capsule, together forming a sclerotized process, rounded at the apex, flat above and with a well-defined median keel below. Aedeagus complicated in structure, the main parts consisting of (1) an upright, somewhat circular dorsal keel within the body; (2) a complex and somewhat quadrate central body forming the base for the other parts; (3) the main extrusible portion of the aedeagus consisting of a curved, neck-like base and an enlarged bulbous structure at the apex which contains extrusible sclerotized hooks and membranous folds; (4) a pair of 2-segmented membranous arms arising at the base of structure 3, and bearing at their apex a sinuate sclerotized rod.

Holotype.—Male; Hot Creek, Raceway Spring, Mono County, California; June 20, 1937; (H. J. Rayner).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—1 ♂; same data as for holotype: 1 ♂; same but June 12. 1 ♂; along Colorado River, Granby, Colorado; July 24, 1938; (H. H. & J. A. Ross). 1 ♂; along Madison River, Ennis, Montana; July 8, 1936; (H. H. Ross).

Paratypes are in the collections of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Protoptila palina new species (Pl. II, fig. 15.)

The long, twisted lateral spines of the aedeagus and the beak-like, caudo-ventral projection of the apex of the aedeagus will serve to differentiate this species from *maculata* (Hagen) to which it is most closely related.

Male. Length 3.5 mm. Color and general structure exactly as given for *coloma.* Distinctive characters apparently confined to the male genitalia.

Male genitalia as in figure 15A. Eighth tergite simple and unmodified. Eighth sternite produced into a long tapering structure, forked at apex and clothed with scattered setae. Ninth segment forming a U-shaped structure almost completely retracted within the eighth, the ventral margin produced into a pair of pointed flaps. Tenth tergite divided into a pair of sclerotized structures which curve laterad, then meso-ventrad, the two almost surrounding the aedeagus in repose; the apex of these lateral lobes is long and tapering, pointed at the apex and forms a definite dorsal hump where it joins the broader basal portion. At this point arises a cercus-like, ovate flap which bears a few scattered setae at apex. Aedeagus composed of four main parts which arise from the central body: (1) an elliptic, stalked, fin-like, basal structure; (2) a ventral pair of short, upturned, hook-like bodies closely appressed together on the meson; (3) the apical, tubular portion which extends beyond the tenth tergite, has a ventral hump at base, a constriction at middle and widens into a long apex which in turn has the caudo-ventral corner produced into a blunt snout; and (4) a pair of appendages arising at the base of the tubular portion, these appendages having an extensile, membranous base in the apex of which is set a long, heavily sclerotized, serpentine rod armed with a group of short setae near apex.

Female. Length 4.0 mm. Color and general structure as for male but body more robust. Genitalia as in figure 15B. Eighth tergite with apex divided into a pair of widely separated lobes, each bearing a scattered group of long setae; between these lobes are a pair of folds which form the attachment for the internal sclerites and just beyond these is a median sclerite bearing a pair of apical styles and forming the base for an internal rod which is slender, somewhat thickened towards apex, narrow and sinuate at extreme apex and which extends close to the ventral margin into the seventh segment. Beyond these structures are a pair of lateral, subconical lobes which represent the tenth tergite and bear apical, style-like appendages. Above the eighth sternite are a pair of sclerotized, broad, flat structures, the dorsal one wider and more or less quadrate, the ventral one elliptic, and perforated with a mesal opening near the anterior margin.

Holotype.—Male; Livingston, Kentucky; June 16, 1935; (H. H. Ross).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—1 ♀; same data as for holotype. 1 ♂; Pineville; June 24, 1938; (T. H. Frison and T. H. Frison, Jr.). 35 ♂; Athens, Susquehanna River, Pennsylvania; August 5, 1937. 1 ♂, 7 ♀; Smoke Hole, Pendleton County, West Virginia; August 10, 1933; (P. N. Musgrave).

Paratypes have been placed with the holotype and in the collection of The Academy of Natural Sciences of Philadelphia.

Protoptila lega new species (Pl. II, fig. 16.)

In size, color, general structure, and basic pattern of the genitalia, this species is identical with *palina* and *maculata* (Hagen). It can be separated from them on the basis of the following characters of the genitalia, mentioned in the key: Tenth tergite with apical portion of lateral arms slightly longer and the basal portion relatively shorter. Aedeagus with the tubular portion more sharply contracted in middle so that the ventral arch is evenly rounded and the apical bulbous portion is set off more distinctly; the caudo-ventral snout of this apical portion is broader and shorter than that of *palina;* the lateral arms of the aedeagus are longer and slenderer, with only the extreme apex angled from the main axis. In the female the general structure of the genitalia is the same, but the ventral internal plate is more parallel-sided, and has the opening closer to the anterior margin. There is a certain amount of variation in the shape and relative measurements of these internal plates and variation met with to date indicates that the differences cited may not hold up for large series of specimens.

Holotype.—Male; Oakwood, Illinois; August 14, 1935; (C. O. Mohr).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—44 ♂, 36 ♀:

ILLINOIS: 4 ♂, 1 ♀; same data as for holotype: 5 ♂, 3 ♀; same data, but June 14, 1935; (C. O. Mohr). 21 ♂, 29 ♀; Mahomet; August 3, 1937; (Ross & Burks). 1 ♂, 1 ♀; Middle Fork River; Danville; August 27, 1936; (Ross & Burks). 1 ♂, 1 ♀; Charleston; September 8, 1931; (H. H. Ross).

MISSOURI: 11 ♂; Hollister; May 16, 1938; (Mrs. Vitae Kite).

WISCONSIN: 1 ♂, 1 ♀; Wisconsin River, Merrill; July 1-2, 1933; (Frison & Mohr).

Paratypes have been placed with the holotype and in the collection of The Academy of Natural Sciences of Philadelphia.

Protoptila alexanderi new species (Pl. II, fig. 14.)

This species is similar in size, color, and structure to the preceding, differing from it in details of the male genitalia as follows: Tenth tergite long, the lateral lobes not markedly angled ventrad, the apical portion shorter than the basal portion, slender and produced into a pointed ventral triangle at apex. Aedeagus with constriction of cylindrical portion very abrupt, so that the ventral margin appears deeply notched at this point and the apex somewhat knob-like; the sclerotized rod at the apex of the lateral membranous appendages is long and slender, obtusely angled near middle and with a few scattered setae near apex.

Holotype.—Male; along San Antonio River, San Antonio, Texas; August 18, 1939; (Harold Alexander).

Key to Males of Nearctic Protoptila

1. Spur count of tibiae 0–3–3........2
Spur count of tibiae 0–4–4........3

2. Lateral lobes of tenth tergite large, projecting, and with an inner, apical sclerotized tooth projecting beyond apex........**jeanae** Ross
Lateral lobes of tenth tergite small, with the apico-ventral corner attenuated........**cantha** Ross

3. Hind wings with anterior margin nearly straight; aedeagus consisting of a pair of sclerotized rods........**thoracica** Ross
Hind wings sabre-shaped, with anterior margin deeply cut away beyond base........4

4. Eighth sternite short and scoop-shaped, not produced into a long or bifid process........**erotica** Ross
Eighth sternite produced into a long or bifid process (figs. 12, 13, 14)..5

5. Eighth sternite elongate but not bifid (fig. 12A)........**balmorhea** Ross
Eighth sternite with apex divided into two distinct points........6

6. Eighth sternite with apico-lateral corner produced into a brushy lobe (fig. 13); apex massive and deeply and widely excavated........7
Eighth sternite with apico-lateral corner angulate, not produced (fig. 14); apex more slender and furcate........8

7. Produced portion of eighth sternite little longer than wide, the apical incision wide and extending almost one-third distance to base.
coloma new species
Produced portion of eighth sternite markedly longer than wide, the apical incision extending only one-tenth to one-eighth distance to base.
tenebrosa (Walker)

8. Apical lobes of tenth tergite truncate, with the ventro-apical corner sharply angulate (fig. 14)........**alexanderi** new species
Apical lobes of tenth tergite tapered and pointed (fig. 15)........9

9. Lateral spine of aedeagus short, stout and abruptly angled near apex.
maculata (Hagen)
(*lloydi* Mosely)
Lateral spine of aedeagus long, slender and only gradually curved (fig. 15A)........10

10. Lateral spine of aedeagus curved only near apex (fig. 16A); apex of aedeagus abruptly narrowed at base (fig. 16)........**lega** new species
Lateral spine of aedeagus sinuate (fig. 15A); apex of aedeagus only gradually narrowed at base (fig. 15)........**palina** new species

Family PHILOPOTAMIDAE

Trentonius distinctus (Walker)

PENNSYLVANIA: Paradise Creek, Monroe County; July 6, 1935, (W. J. Harmer, 4 larvae, [ANSP]. Shohola Creek, Pike County; May 20, 1935, (W. J. Harmer), 1 larva, [ANSP]. Brodhead Creek, Monroe County; June 23, 1935, (W. J. Harmer), 1 ♀, [ANSP].

Trentonius dorcus (Ross) new combination

1938. *Philopotamus dorcus* Ross, Bull. Ill. Nat. Hist. Surv., XXI, (4), p. 132, March.

1938. *Philopotamus oregonensis* Ling, Pan-Pacific Ent., XIV, (2), p. 63, June. (New synonymy.)

W[ASHINGTON] T[ERRITORY]: 1 ♂, [ANSP].

Dolophilus anillus new species (Pl. III, fig. 18.)

This species is most closely related to *occideus* Ross and *strotus* Ross; it differs from the former in having no ventral projection on the sixth abdominal sternite and from both of them in the short, basal segment and constricted apical segment of the claspers.

Male. Length 8 mm. Color dark brown except for indefinite areas on the femora and tibiae which are a slightly lighter shade. Structure typical for genus. Spur count of the legs 2-4-4, all spurs long. Fore and hind wings with the fork R_{2+3} and R_{4+5} sessile.

Genitalia as in figure 18. Ninth segment annular, constricted dorsad to form a very narrow and more or less indefinite bridge. Tenth tergite triangular, the mesal line shaped carinate and very high; it is practically devoid of setation and bears only a few pores at apex. Cerci very slightly sinuate, slightly shorter than tenth tergite and pointed at apex; they are clothed with sparse setae which are longest at apex. Claspers with basal segment slightly shorter than apical segment although the reverse appears true if the apical segment is bent mesad; the basal segment is round and covered with sparse setae of moderate length; the apical segment is very definitely constricted beyond the base and the apex forms a circular, spatulate area; the entire segment clothed with setae slightly longer than that on the first segment. Aedeagus largely semimembranous or membranous and indistinct.

Holotype.—Male; Stave Falls, British Columbia; July 6, 1940; (H. H. & J. A. Ross; along very small brook).

Paratypes.—5 ♂; same data as for holotype. 1 ♂; Vancouver, Marine Drive, British Columbia; July 5, 1940; (H. H. & J. A. Ross). 4 ♂; along Beaver Creek, tributary of Sandy River, Clackamas Co., Oregon; February 3, 1939; (S. G. Jewett, Jr.).

Paratypes are in the collections of the Illinois Natural History Survey, The Academy of Natural Sciences of Philadelphia, and Mr. S. G. Jewett, Jr.

Dolophilus arizonensis Ling

This species has not been recorded since its original description. The type locality is "Arizona."

ARIZONA: Huachuca Mountains; July, 1907, 1 ♂, [ANSP].

Dolophilus moestus (Banks)

This is one of the commoner species in small, rapid streams in the eastern states.

NEW JERSEY: Between Point Pleasant Creek and Frenchtown, Hunterdon County; (J. W. H. Rehn), 1 ♂, [ANSP].

NEW YORK: Ringwood; April 30, 1937; 1 larva, [ANSP].

PENNSYLVANIA: Saw Creek, Monroe County; May 19, 1935, (W. J. Harmer), 1 ♂, [ANSP].

Chimarrha aterrima Hagen

This is the first definite record of this species from Pennsylvania, although its known range extends from Ontario to Florida through the eastern states.

PENNSYLVANIA: (S. F. Aaron), 1 ♂, [ANSP].

Chimarrha feria new species (Pl. II, fig. 17.)

The shape of the claspers and tenth tergite shows this species to be most closely related to *aterrima* Hagen. It differs from this species, however, in the long, sinuate, apical blade of the claspers and the great production of the apical point of the claspers.

Male. Length 6 mm. Color black, with a slight intermingling of dark brown and with central areas of the femora yellowish. Structure typical for genus, including spur count, wing venation, and mouthparts.

Genitalia as in figure 17. Ninth segment with ventral portion widest, bearing a short, triangular, mesal projection; dorsal portion reduced to a narrow band which appears fused with the base of the tenth tergite. Tenth tergite divided into a pair of blade-like lateral lobes, each armed with a high, thick, sclerotized ridge which is sinuate and recurved into a hook at apex; these two lateral blades are separated by a triangular, membranous, mesal lobe. Cerci small, irregular in shape, clothed with scattered long setae, and situated just below the base of the tenth tergite. Claspers more or less triangular, dorsal angle slightly curved and more or less angled, apical margin slightly concave, ventral margin quite rounded; along the dorsum of the apical margin is a bare, sinuate blade which projects beyond the mesal margin; directly below this is a short, heavily sclerotized, fingerlike projection. Aedeagus wide and tubular, the ventral portion of the base membranous, the apex thrown up into a series of membranous folds; internally there are two long, curved, sclerotized rods which constitute the only armature of the organ.

Female. Length 7.2 mm. Color and structure identical with male, genitalia apparently the same as those for the other species in the genus.

Holotype.—Male; Vienna, Illinois; May 29, 1939; (Burks & Riegel).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—212 ♂, 28 ♀, 44 immature.

Illinois: 64 ♂, 10 ♀, 1 mating pair; same data as for holotype. 1 ♂; Dixon Springs; July 9, 1935; (DeLong & Ross). 1 larva; Golconda; May 11, 1935; (C. O. Mohr). 38 ♂, 13 ♀; Gibbons Creek, Herod; March 28, 1935; (Ross & Mohr): 1 ♂, 1 pupa; March 28, 1935; (Ross & Mohr). 3 larvae; Gibbons Creek; September 11, 1937; (H. H. Ross): 11 ♂; June 21, 1935; (DeLong & Ross): 3 ♂; July 27, 1938; (Burks & Boesel): 20 ♂, 2 ♀; July 11, 1935; (DeLong & Ross): 2 ♂; May 12, 1936; (Mohr & Burks). 30 larvae; Grand Pierre Creek, Herod; July 29, 1898; (Hart): 15 ♂; May 1, 1936; (Ross & Mohr). 8 larvae; Waltersburg; March 24, 1939; (Ross & Burks).

Arkansas: 9 ♂, 1 ♀; Mt. Pine, McFadden Springs; June 5, 1937: (H. H. Ross): 45 ♂; June 5, 1937; (H. H. Ross). 1 ♂, 1 ♀; Mt. Sequoyah, Washington Co.; July 28, 1938; (M. W. Sanderson; at light).

Indiana: 1 larva; Needmore, September 12, 1937; (H. H. Ross).

Missouri: 1 ♂; Zion, Madison Co.; April 7, 1938; (Frison & Mohr).

Oklahoma: 1 ♂; Reagan; June 1, 1937; (H. H. Ross): 9 ♂, 7 ♀; Turner Falls State Park, Honey Creek; June 2, 1937; (H. H. Ross). 14 ♂; Page; June 23, 1937; (Standish-Kaiser). 1 ♂; Ada; May 31, 1937; (H. H. Ross).

Texas: 3 ♂; Linden; April 15, 1939; (H. H. & J. A. Ross).

Wisconsin: 5 ♂, 1 mating pair; Wisconsin River, Merrill; July 1 & 2, 1933; (Frison & Mohr): 10 ♂, 2 mating pairs; June 18, 1934: 1 ♂; July 24, 1937; (Frison & Ross; at light): 15 ♂; July 2, 1933; (Frison & Mohr). 1 ♂; Teal Creek, Hayward; July 5, 1933; (Frison & Mohr). 4 ♂; Chippewa River Bridge, Moose Lake, Hayward; August 12, 1938; (T. H. Frison & T. H. Frison, Jr.). 1 ♂; Namekagon River, Spooner; June 5–6, 1936; (Frison & Ross).

Paratypes are in the collections of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Chimarrha obscura (Walker)

This record extends the known range of this species considerably. It has heretofore been recorded from the northeastern states.

ARKANSAS: Five miles north of Jasper, Newton County; Aug. 11, 1939, 1000 feet alt., (Rehn & Rehn), 2♂, [ANSP].

Chimarrha socia Hagen

This species is taken less commonly than others in the genus.

NEW JERSEY: Browns Mills; May 26, 1900, 1♂, [ANSP].

FAMILY HYDROPTILIDAE

Oxyethira aculea new species (Pl. III, fig. 19.)

The genitalia of this species is midway between the type for *Dampfitrichia* and the typical *Oxyethira* type, so much so that it seems necessary at this time to consider *Dampfitrichia* at the most a group name and not of generic status. The present species is most closely related to *ulmeri* Mosely, the genotype of *Dampfitrichia,* and differs from it in the longer lateral pieces of the eighth tergite and other characters of the genitalia.

Male. Length 2.5 mm. Color, the typical salt and pepper type found in many other species of this group. General structure typical for genus. Seventh segment with a sharp mesal projection. Diagnostic characters confined to the genitalia. Eighth tergite with base humped and bearing a cluster of long setae and with the apex produced into a pair of long, sclerotized rods, widely separated at base but converging and almost meeting towards tip. Eighth sternite produced into long, posterior, plate-like extensions which form a shield for the rest of the genitalia. Ninth segment with base sinuate and forming a medium ventral projection extending into the seventh segment. Tenth tergite inverted U-shaped, seen from the side, and arrowhead-shaped and pointed, seen from above, bearing at each side a pair of smooth, membranous, fusiform appendages which have a long seta at tip. Claspers apparently fused into a single wide structure with a slightly emarginate apex which is visible through the ventral emargination at the apex of the eighth sternite. Aedeagus simple, tubular, the basal portion wide, narrowing rather abruptly to a more or less rod-like, apical structure which is narrowed and curved at the extreme apex.

Holotype.—Male; along Honey Creek, Turner Falls State Park, Oklahoma; June 2, 1937: (H. H. Ross).

Paratypes.—4♂; same data as for holotype. 2♂; Carlsbad, Pecos River, New Mexico; April 29, 1939; (J. A. & H. H. Ross).

Paratypes are placed in the collections of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Polytrichia logana new species (Pl. III, fig. 23.)

The pointed claspers will separate this species from other members of the genus with the exception of the two following. From these it may be readily separated by characters of the tenth tergite as explained in the description.

Male. Length 3 mm. Color and general structure typical for genus, the body and appendages being dark brown, the wings dark with a few scattered, white flecks and anatomical details other than genitalia practically identical with related species.

Male genitalia as in figure 23. Ninth segment more or less quadrate from side view, incised on the dorsum almost to the base to make a wide incision in which rests the tenth tergite; tenth tergite with the basal portion shield-like, the apical portion divided into a cluster of sclerotized rods and membranous areas. The central portion of the apex is bounded on the left by A which is sclerotized and hooked at the end, the right portion is made up of semimembranous folds ending in a membranous and setate disk surrounded by semisclerotized areas; this assemblage is held at an angle diagonal to the cross section, higher on the left and lower on the right. B is short, with a wide base and a pointed apex angled rather sharply laterad, the entire sclerite heavily sclerotized. C is long and pointed, the base semimembranous and attached near the base of B. D is semimembranous on the basal half, the apical half being heavily sclerotized and curved abruptly into a semicircle, so that its greatest length is shorter than E. E is slightly sinuate towards apex, heavily sclerotized, longer than D and almost twice as long as B. F has a wide base which tapers rapidly to a downward hook. Claspers relatively symmetrical, sinuate, the apex pointed and provided with a single, stout, apical spine pointing mesad and with the ventral margin notched about three-fifths distance from base; the mesal margin at the end and below the point of this notch is armed with a scattered row of black spines; a similar spine or two appear on the mesal margin below the apex.

Female. Size, color, and general structure as for male. Genitalia as in figure 23C. Seventh segment with a mesal carina on the apical margin. Eighth tergite simple, clothed with scattered setae with a slight cluster around the apical margin. Eighth sternite with a shield-shaped area set out on the ventral margin; this area has the ventral surface clothed with scattered setae but has an inner wall which has a squarish reticulate texture. Bursa copulatrix long and attenuated, similar to other members of the genus.

Holotype.—Male; Logan Canyon, Utah; August 4, 1938; (D. E. & A. T. Hardy).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—

UTAH: 5♂, 1♀; same data as for holotype: 2♂; same data as for holotype, but August 7. 2♂, 16♀; Logan; August 10, 1938; (Knowlton & Hardy; at light): 1♂, 5♀; August 3: 19♂, 50♀; August 9: 70♂, 65♀; August 8: 1♀; September 6, 1938; (Knowlton & Nye): 4♂, 4♀; August

10–12: 35♂, 35♀; August 24; 1♂, 1♀; July 19, 1938; (D. E. Hardy). 1♂; Spring Hollow, Logan Canyon; July 21, 1938; (D. E. & A. T. Hardy): 1♂, 1♀; July 6, 1939; (Knowlton & Harmston). 12♂, 12♀; Beaver Canyon, Duchesne Co.; July 24, 1939; (Zirker). 10♂; Ogden Canyon; July 6, 1939; (Knowlton & Harmston).

Paratypes are placed in the collections of the Illinois Natural History Survey, Utah State Agricultural College, and The Academy of Natural Sciences of Philadelphia.

Polytrichia lometa new species (Pl. III, fig. 24.)

This species differs from *logana* in the structures of the tenth tergite, in particular, having sclerite B longer than E, D longer than E, and F almost straight and not hook-like.

Male. Size, color, and general structure identical with *logana*.

Genitalia as in figure 24. Ninth segment as for *logana*. Tenth tergite divided into sclerotized rods and parts homogeneous with those of *logana* but differing as follows: B long, sinuate, and only moderately curved at apex, almost as long as D and longer than E; C plate-like and pointed; D membranous at base, the apex pointed but not constricted, extending markedly beyond E; E short, relatively robust, curved laterad and saber-shaped; F almost straight. Claspers as in *logana* but with the apical triangle not so robust.

Female. Size, color, and general structure as for male. Genitalia apparently indistinguishable from *logana*.

Holotype.—Male; High Rolls, New Mexico; April 25, 1939; (H. H. & J. A. Ross).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—New Mexico. 2♂, 1♀; same data as for holotype. 1♂; Beaver, Utah; April 21, 1939; (Knowlton & Harmston).

Paratypes are placed in the collections of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Polytrichia mono new species (Pl. III, fig. 20.)

This species is most closely related to *oregona* Ross, but differs from it in the boot-shaped clasper.

Male. Size, color and general structure as given for the preceding. The genitalia as in figure 20. Eighth sternite simple, ninth segment annular except for a deep incision on the dorsum for reception of the tenth tergite. Tenth tergite with sclerite A humped near base and sharply angled at apex. In addition to this, there are only four sclerotized rods; one to the left of A (probably B) is upturned and has a somewhat pear-shaped process at the apex; to the right of A are the other 3, a mesal, upturned, hook-like, heavily sclerotized one which is probably D, a short, blade-like one (E), and F which is long and blade-like, reaching three-quarters of the distance to the apex of A. Claspers with the lateral aspect almost triangular, in many respects resembling an upside down shoe, the apex straight margined and triangular, with a spine at tip. Seen from ventral view, the two are slightly asymmetrical, the left one more sinuate than the right, each suddenly constricted just before the middle, with the mesal face concave in both directions, and with a cluster of stout black spines on the dorsal surface of the mesal angle. Aedeagus simple and tubular as in other members of the genus.

Female. Similar in size, color, and general structure to male. Genitalia almost exactly like those of *logana* but with the shield-shaped sclerite of the eighth sternite more rounded at apex.

Holotype.—Male; Hot Creek, Raceway Spring, Mono County, California; June 20, 1937; (H. J. Rayner).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—1 ♂, 1 ♀; same data as for holotype. 4 ♂; same but May 1, 1939.

Paratypes are in the collections of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Polytrichia unio new species (Pl. III, fig. 25.)

This species is closely related only to *xena* Ross, but differs from it markedly in the vasiform tenth tergite and in having only a single brush of black, peg-like setae at the apex of the claspers.

Male. Length 2.3 mm. Color brown; head and antennae dark brown, thorax and abdomen mottled brown and whitish. Legs luteous, with middle and hind tarsi and most of hind tibiae black. Wings dark brown with a narrow whitish band just before middle, a white spot on the costal and anal margins two-thirds distance from base, and a whitish spot at extreme apex. General structure typical for genus, including large ocelli, filiform antennae and spur count.

Genitalia as in figure 25. Ninth segment dorso-ventrally flattened, the ventral margin sinuate, the basal projection very long. Tenth tergite semimembranous, small, and without processes or spines of any description; the basal portion is slightly enlarged and the apical portion is narrower, giving it a vase-like outline; its dorsal surface bears one or two irregular striations and an irregular, transverse area near the middle where the epidermis is completely membranous. Claspers very long and narrow, symmetrical, clothed with long, silky hair over the mesal and lateral margins and with a conspicuous brush of black peg-like setae on the mesal face at apex. Aedeagus long, filamentous and inconspicuous, identical with other species of the genus.

Female. Length 2.5 mm. Color and general structure similar to male. Apex of abdomen tubular, the bursa copulatrix very long and shaped like a tuning fork as in other members of the genus.

Holotype.—Male; Union Spring, Alto Pass, Illinois; May 25, 1940; (Mohr & Burks).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—10 ♂, 2 ♀; same data as for holotype. 1 ♂; Hutchins Creek, Wolf Lake, Illinois; May 31, 1940, (B. D. Burks).

Paratypes are in the collection of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Polytrichia eliaga new species (Pl. III, fig. 22.)

The row of four or five black, peg-like setae at the apex of clasper and the irregular row of black setae near the shoulder of the clasper will distinguish this species from others of the genus. It is most closely related to *spinosa* Ross, but lacks the angular projection of the ventral margin of the left clasper, in addition to the details mentioned above.

Male. Length 2.3 mm. Color and general structure typical for genus and identical with the preceding, including characters of the ocelli, antennae, and spurs. Diagnostic characters confined to the male genitalia.

Genitalia as in figure 22. Ninth segment cylindrical and short, the dorsal portion divided nearly to base and tenth tergite inserted in this area. Tenth tergite long and hooked, consisting of a long, blade-like central portion, bearing at the base a pair of stout, black, upturned spurs and two long, fingerlike, light colored blades; these structures of the tenth tergite are typical for the *spinosa* group. Claspers almost symmetrical; lateral aspect sinuate, the bend occurring close to the base, the apical portion slightly spatulate and rounded at apex; ventral aspect with base fairly broad, narrowed before middle to form a mesal, shoulder-like area which bears an irregular group of uneven, black, peg-like setae; mesal margin of the apex bears a group of four to five long, black, peg-like setae directed mesad and forming an evenly spaced row on ventro-caudal arc; outer surface covered with long hair, inner surface of apical portion bearing numerous long, slender setae pointed mesad.

Female. Length 2.5 mm. Color and general structure similar to male. Apex of abdomen tubular, bursa copulatrix long and shaped like a tuning fork, as in other members of the genus.

Holotype.—Male; Jasper, Tennessee; April 25, 1938; (Ross & Burks).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—1 ♂; along Hutchins Creek, Wolf Lake, Illinois; May 31, 1940; (B. D. Burks). 1 ♂, 1 ♀; same data as for holotype.

Paratypes are in the collections of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Polytrichia arva new species (Pl. III, fig. 21.)

The general structure of the genitalia of this species is most closely related to *spinosa* Ross and *eliaga* Ross. It differs from *eliaga* in lacking the row of black spines at the apex of the claspers and from *spinosa* in lacking the triangular projection of the middle of the ventral margin of the claspers; in addition, it differs from both in other details of the genitalia.

Male. Length 2.5 mm. Color and general structure typical for genus. Genitalia as in figure 21. Ninth segment cylindrical and short, dorsal portion divided nearly to base and tenth tergite inserted in this area. Tenth tergite long and hooked, the central, blade-like portion reaching almost the middle of the clasper, bearing at the base a pair of stout, black, upturned spurs which are smaller and farther apart than in the preceding species and two finger-like, light colored blades, the ventral one being broader and more hooked than in the preceding species. Claspers almost symmetrical but with slight difference in setal placement on the two; lateral aspect sinuate, the ventral margin very evenly and gently curved, the apex decidedly narrower than the central portion; ventral aspect with base broad, narrowed just before middle to form a mesal, shoulder-like area which bears an irregular cluster of unequal, black, peg-like setae; the group on the left clasper has the largest spine set out definitely from the remainder, and it is a true spur and not a seta; mesal margin of the apex with one or sometimes two long, black peg-like setae directed mesad; outer surface covered with long hair, inner surface of apical portion bearing numerous long, slender setae pointed mesad.

Holotype.—Male; Martin Springs, Tennessee; April 25, 1938; (Ross & Burks).

Paratypes.—19 ♂; same data as for holotype.

Paratypes are in the collections of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Polytrichia anisca new species (Pl. IV, fig. 27.)

The curious clock-spring structure of the left stem of the tenth tergite places this species as a close relative of *shawnee* Ross. It differs from *shawnee,* however, in the stout, side process C of the right side of the tenth tergite; this process curves sharply away from the base and then curves abruptly back across its parent stem; sclerite D is short and stout and the clock-spring on B is closer to the apex and covers almost all the basal enlargement of the hook F.

Male. Length 2.7 mm. Color dark brown, typical for other members of the genus. General structure apparently the same as for other members of the genus, including characters of ocelli, tibial spurs, and venation.

Genitalia as in figure 27. Ninth segment short and cylindrical, the dorsal area excavated almost to the base to form a wide, U-shaped area into which the tenth tergite fits. Tenth tergite composed of two long, sclerotized processes, A and B, the membranous area between them and each process with various complex specializations. The left sclerite, B, has a small tooth at base and a larger, blade-like process near the middle, this process closely appressed at its sclerite; near the apex, B loops in a coil and is produced beyond this into an apical hook, F.

The right sclerite, A, has near its base a stout, wide ribbon, C, which curves abruptly mesad and then abruptly laterad, crossing its parent sclerite and with the apex fusiform; above the junction of C, A widens and forms the base for the heavily sclerotized process, D, which is short, blunt, and separated by its own length or more from the spiral of B; the lateral portion of A continues beyond the spiral as a slender, sinuate process with its apex obliquely truncate and the tip pointed. Claspers very similar to those of other members of the *shawnee* group, the lateral aspect shoe-shaped, ventral aspect with a row of black, peg-like teeth on the apical half of the mesal margin, the left clasper with a small group of setae on a short, stump-like projection. Aedeagus slender and filamentous as in other members of the genus.

Female. Length 2.7 mm. Color and general structure as for male. Apex of abdomen tubular, bursa copulatrix long and shaped like a tuning fork, as in other members of the genus.

Holotype.—Male; Wolf Lake, Illinois; May 31, 1940; (B. D. Burks).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—224 ♂, 200 ♀; same data as for holotype. 20 ♂, 24 ♀; LaRue, Illinois; May 26, 1939, McCann School; (Burks & Riegel). 8 ♂, 3 ♀; Mountain Pine, Arkansas; June 5, 1937; (H. H. Ross). 3 ♂, 1 ♀; Hochatown, Oklahoma; May 6, 1939, Mt. Fork River; (R. & K. Weddle).

Paratypes are in the collection of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Polytrichia contorta new species (Pl. IV, fig. 26.)

This species is most closely related to *anisca,* the preceding. It differs from it in the shorter tenth tergite complex and the very stocky proportions of all its component parts; in addition, the process E is shorter, tapers to an even point, and stops some distance from the apex of F; the process D ends very close to the spiral; and sclerite A is exceedingly wide.

Male. Length 2.3 mm. Color dark brown, together with the general structure typical of the preceding species.

Male genitalia as in figure 26. Ninth segment short and cylindrical, the dorsal portion almost completely incised to form a U-shaped area into which the tenth tergite fits. Tenth tergite with left sclerite B stout and sinuate, with a small basal tooth and an appressed blade near middle, forming a large spiral and beyond this terminated by the long process F which is distinctly hooked. Right sclerite A with process C ribbon-like, curved abruptly mesad at base and then abruptly laterad, almost completely closing at parent sclerite; A itself becomes very wide at the point of junction of C and continues to widen towards apex; process D is heavily sclerotized, large, and somewhat pointed and almost touches the spiral; the lateral portion of A continues beyond the spiral as an evenly tapering short process E, which is sharply pointed at apex. Claspers shoe-shaped and aedeagus slender and filamentous as in the preceding species.

Holotype.—Male; Greer Spring, Missouri; March 28, 1937; (T. H. Frison).

Paratypes.—17 ♂; same data as for holotype.

Paratypes are in the collection of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Neotrichia kitae new species (Pl. IV, fig. 29.)

This species is most closely related to the species *hiaspa* Mosely, the genotype of *Lorotrichia.* It differs from that species, however, in the different shape of the subgenital plate and various other processes of the male genitalia. The female genitalia is remarkably similar to the subgenus *Exitrichia* and also the group *Neotrichia s. st.* With this evidence, it seems necessary to consider *Lorotrichia* as a group of species within the genus *Neotrichia.*

Male. Length 2 mm. Color brown. General structure typical for genus including presence of ocelli which are close to the inner margin of the eye, sharp forewings and reduced hindwings, and legs with a spur count of 0–2–3.

Genitalia as in figure 29. Ninth segment annular, the invaginated basal portion somewhat pointed and produced into a short tail, the ventral portion narrowed to a bridge and the dorsal portion apparently fused with the tenth tergite and forming a pair of long, divergent plates, A. From the lateral face arises a cercus-like structure, B, which has a wide, long, ventral blade and a sinuate, narrow, dorsal arm, both arising free from the rest of the genitalia; the base of this structure has a cluster of long setae. The claspers, C, are short and simple with only two or three setae. Above the claspers arise a pair of filiform appendages, D, and between these a large subgenital plate, E, with its typical pair of spines at apex; the apical half of the plate is produced ventrad into a thick mesal ridge. Aedeagus with a wide, tubular, basal portion twice as long as the apical portion; this narrows to a short neck which bears a long spiral process encircling the neck once and following the aedeagus to near the head of the apex; the apical portion consists of a slightly irregular stock beyond which is a pair of heavily sclerotized hooks set in a membranous base.

Female. Size, color, and general structure as for male. Genitalia as in figure 29. Very similar to those of *okopa* in general characteristics: eighth sternite almost entirely membranous, the apex surrounded by a circle of six setae; below this circle is a sclerite shaped as in illustration; bursa copulatrix long and narrow, the anterior portion having a dorsal bridge, the posterior portion attenuated into a rounded membranous structure from which arises a pair of folds which become sclerotized at their apex.

Holotype.—Male; Hollister, Missouri; July 14, 1938; (Mrs. Vitae Kite).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—331 ♂, 350 ♀; same data as for holotype.

Paratypes are in the collection of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Neotrichia riegeli new species (Pl. IV, fig. 30.)

This species is most closely related to *falca* Ross, but differs from it in the truncate claspers and very large mesal hooks of the male genitalia and by the large, rounded, subgenital plate of the female, in addition to other details of the genitalia in both sexes.

Male. Length 2.1 mm. Color straw colored with abdomen and irregular parts of other sclerites light brown. General structure typical for genus, including size and position of ocelli, tibial spurs, and narrow, pointed wings.

Genitalia as in figure 30. Ninth segment cylindrical, produced basad into a pair of short, divergent arms. Tenth tergite large and submembranous, projecting beyond other parts of the genitalia. Claspers short, subquadrate, with three or four long setae near base and with a densely sclerotized black area at apex. Cerci long, semimembranous, short, widest near middle and tapering to a blunt apex, clothed with a few scattered setae. Above the claspers arise a pair of heavily sclerotized hooks and attached to each of these is a dorsal, membranous fold terminating in a flat, ovate area bearing a single large seta. Aedeagus as in figure 30A, with base very wide and triangular, neck irregular and bearing a long tubular process and apex consisting of an irregular attenuated portion which bears two large, irregular, sclerotized hooks which are always situated one above the other and not side by side.

Female. Size, color and general structure typical for male. Abdomen tubular. Eighth sternite with an apical row of six long setae, with a subgenital plate large, rounded at apex, and heavily sclerotized, set off from the lateral, sclerotized area by deep membranous valleys. Bursa couplatrix as in figure 30B.

Holotype.—Male; Lusk Creek, Eddyville, Illinois; June 19–20, 1940; (Mohr & Riegel).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—10 ♂, 20 ♀; same data as for holotype.

Paratypes are in the collections of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Neotrichia edalis new species (Pl. IV, fig. 31.)

The thumb-like process on the aedeagus and the subquadrate claspers separate this species from the Mexican *exicoma* Mosely, which is its closest ally.

Male. Length 2.0 mm. Color very light brown with the abdomen darker. General structure similar to the preceding. Eighth sternite with a mesal comb of large setae near apex. Genitalia as in figure 31. Ninth segment cylindrical, produced baso-laterad into a pair of short, slender rods. Tenth tergite submembranous and forming a shelf over the remainder of the genitalia. Cerci long, finger-like and semimembranous, bearing a few scattered setae. Claspers subquadrate, with four short setae at their base, the apex slightly excavated and the apico-mesal corner higher than the apicolateral corner. Above this is a pair of sclerotized bands which almost meet on the meson. Above these is a curious, mesal, head-like structure which projects above and beyond the claspers; its lateral aspect is irregular, its ventral aspect bilaterally symmetrical, each side surmounted by a stout seta. Aedeagus with base very short and triangular, neck confluent with apex and bearing a long, thread-like, filamentous, apical portion consisting of a long, tubular, apical portion and an expanded membranous apex which bears two, pointed, thumb-like lobes.

Female. Size, color, and general structure as for male. Eighth sternite with the typical row of long setae at apex; subgenital plate heavily sclerotized, triangular and tapering to a narrow apex, definitely set off from the rest of the segment which is semimembranous and not darkened. Bursa copulatrix as in figure —.

Holotype.—Male; along Pennington Creek, Reagan, Oklahoma; June 1, 1937; (H. H. Ross).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—4 ♂, 2 ♀; same data as for holotype: 2 ♂, 1 ♀; July 1, 1939, (Mrs. R. Weddle): 1 ♂; July 9, 1938, (Mrs. R. Weddle).

Hydroptila acadia new species (Pl. V, fig. 32.)

This species is closely related to both *salmo* Ross and *waubesiana* Betten. It is distinguished from the former by the short hook on the end of the claspers and the longer aedeagus (Fig. 32), and from the latter by the membranous nature of the lobes of the tenth tergite. From both species it may be easily separated by the additional condition of having the ninth segment only half the length of the eighth and retracted within the deep, dorsal incision of the eighth. The female differs from *waubesiana* in the bulbous base of the eighth tergite (Fig. 33) and the produced apex of the same.

Male. Length 2.5 mm. Color and general structure typical for genus. Seventh sternite with mesal projection minute or entirely lacking. Eighth segment long, the lateral margin armed with two or three stout, black spines and abundant hair, the ventral margin incised about midway to base and the dorsal margin incised almost two-thirds the distance to the base. The dorsal portion of the segment adjacent to the incision is membranous and difficult to distinguish.

Male genitalia, as in figure 32. Ninth segment small, retracted within the basal portion of the eighth; dorsad, it is reduced to a very small bridge, but ventrally, it forms a broad area from the base of which arises a strong, median carina which attains half the height of the segment and to which the very long claspers are attached. The lateral portions of the segment are produced into a subtriangular lobe apparently destitute of setae and the dorsal portion forms a small projection over the base of the tenth. Tenth tergite large and very long, mostly membranous, but with a forked, sclerotized band arising dorso-basad and ending apico-ventrad; the depth of the segment greatly exceeds its width and the apex is divided into a pair of membranous, divergent lobes appearing narrow from above and wide from the side. Claspers long, regular for most of their length, the base curled foot-like and the apex narrowed and formed into a hook; the sides are furnished with a scattered row of short setae. The claspers lie close together and scarcely extend beyond the lateral margins of the tenth tergite.

Aedeagus as in figure 32B; the basal portion is short and tapered, the neck longer than the base, very slender, expanded at its apex and provided near this point with a slender, thread-like spiral which encircles it almost twice; apical portion about as long as the neck, even tapered and slightly sinuate at the extreme apex.

Female. Length 3.0 mm. Color and general structure typical for genus, the chief differences lying in the eighth segment. Eighth sternite strongly sclerotized and set off markedly from the wider and less sclerotized tergite, cylindrical for most of its length but with the base expanded and more or less bulbous; the apical margin has truncate corners with a moderately produced, arcuate, mesal area; below the apical margin is an irregular row of about eight slender setae; eighth tergite with basal half considerably expanded; its apical margin is deeply and evenly incised, as in figure 32D, and just below the margin is an irregular row of six to eight setae. Bursa copulatrix typical for genus.

Holotype.—Male; Hubbard, Nova Scotia; August 22, 1939; (T. H. & T. H. Frison, Jr.).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—5 ♂, 100 ♀; same data as for holotype. 1 ♀; Chester Basin, Nova Scotia; August 23, 1939; (T. H. & T. H. Frison, Jr.).

Paratypes are in the collection of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Hydroptila pecos new species (Pl. V, fig. 34.)

The combination of entire tenth tergite and shape of claspers and aedeagus found in this species shows it to be a true intermediate form between *consimilis* Morton and its allies on the one hand and *perdita* Morton on the other. The entire tenth tergite separates it from *consimilis, angusta,* and other related members of the genus, and the wide claspers with their widely separated, sclerotized points separate it from *perdita.*

Male. Length 2.5 mm. Color and general structure typical for genus, the former being the common salt-and-pepper mottling over the entire body and wings. Seventh sternite with a small, pointed mesal process. Eighth segment cylindrical, with sclerotized tergite and sternite as in most of the species in the genus.

Genitalia, as in figure 34. Ninth segment annular, the lateral margin of the basal portion only moderately produced into a gently rounded area; the apical margin has a lateral production of the ventral half into a large, ovate lobe whose ventro-caudal margin is clothed with a row of fine setae. Both dorsal and ventral portions have a wide mesal bridge. Tenth tergite separated from ninth only by indistinct folds; it is very wide, figure 34B, and almost truncate at apex, mostly semimembranous with a mesal and a pair of lateral, weakly sclerotized, linear, narrow bands. Claspers short and stocky, gradually flaring towards apex, the apical angles sharply pointed and slightly sclerotized; the lateral face has a setate ridge very close to the dorsal margin, which latter has no setae; the apical margin is curved and provided with a few sensory pits; the ventral margin and lateral face are provided with a few short, scattered setae. The base is produced into a triangular lateral process which bears one lone macrochaeta.

Aedeagus, as in figure 34C. The basal tubular portion is regularly cylindrical and three times as long as the vasiform apical portion. The "neck" has a membranous extensile base and above that is a sinuate portion which fits into the apical part; from the center of the neck arises the stout spiral process which encircles the aedeagus one and one-half times, its end reaching midway to the apex. The apical portion is broadest at the base where it is truncate and fits over the end of the neck; from the base it tapers in a somewhat sinuate fashion to the apex at which point it bears a stout, curved, pointed projection at right angles to the axis.

Holotype.—Male; along bank of Pecos River, Carlsbad, New Mexico; April 25, 1939; (H. H. & J. A. Ross).

Paratypes.—29 ♂; same data as for holotype.

Paratypes are in the collection of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Hydroptila xella new species (Pl. V, fig. 35.)

This species is probably most closely related to such species as *dentata*. It differs from this and all others in the genus, however, in the sclerotized apico-lateral process of the ninth tergite and the curious bilobed claspers.

Male. Length 2.5 mm. Color and general structure typical for genus, the former being the common salt-and-pepper mottling over the entire body. Seventh sternite with a long, sinuate, mesal process clothed with dense setae.

Genitalia as in figure 35. Ninth segment somewhat bulbous, constricted ventrally to a narrow, mesal bridge, the lateral margin produced into a subtriangular, apico-ventral portion, the dorso-lateral corner produced into a heavily sclerotized, sinuate process. This pair of processes angle sharply mesad at extreme apex and the left one is slightly longer than the right. Tenth tergite apparently represented only by a membranous fold. Claspers with a small base, the apex bulbous as seen from ventral view, and bilobed as seen from the lateral view; the outer lobe is smooth and almost truncate at the apex; the inner lobe is knob-like and covered with fine, close reticulations. Above the claspers arise two mesal processes: a ventral one which curves over the claspers and ends in a broad, ventrally expanded apex covered with a cushion of fine setae; the other arising above this, and extending slightly beyond it, its apex sinuate, produced on the meson, and bearing a pair of isolated setae one on each side of the meson. Aedeagus long, consisting of a long base gradually tapering to a narrow neck which in turn is joined to the apical portion; the neck bears a stout, spiral process which encircles it one and one-half times as in figure 35B; the apical portion is joined broadly with the neck, tapers to just before apex, this apex flared into a semispatulate angulation; below this there arises a curved spine as in figure 35B.

Female. Similar in size, color, and general structure to male. Eighth sternite cut-away at the sides. The mesal portion as in figure 35C, forming a broad, rectangular base from which arises a somewhat quadrangular, mesal projection bearing a cluster of about six long, conspicuous setae. Bursa copulatrix typical for genus.

Holotype.—Male; Martin Springs, Tennessee; April 25, 1938; (Ross & Burks).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—7 ♂, 8 ♀; same data as for holotype.

Paratypes are in the collection of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Hydroptila salmo new species (Pl. VI, fig. 37.)

The simple and widely curved claspers separate this species from its nearest ally, *waubesiana* Betten.

Male. Length 2.5 mm. Color and general structure typical for genus, the former consisting of the usual salt-and-pepper mottling so common in the family. Seventh sternite with a short, pointed mesal process.

Genitalia as in figure 37. Ninth segment retracted within eighth, narrowed above and below along the meson, but with the lateral portion not produced far into the body cavity; the lateral portions are rounded at the base. Tenth tergite semimembranous, very narrow basally, the apex widened and bilobed; the lateral margin is composed of a sclerotized strip which covers the entire base and rapidly narrows towards apex; beneath this arises a process wide in the base and rapidly narrowing to a narrow, blunt apex with a hook-like projection on each side.

Holotype.—Male; Trout Lake, Wisconsin; July 21–23, 1937; (H. H. Ross).

Hydroptila rono new species (Pl. V, fig. 36.)

The aedeagus indicates that this species is most closely related to *amoena,* but the tenth tergite and fused, specialized claspers separate *rono* at once both from *amoena* and all other species of the genus.

Male. Length 4 mm. Color various shades of brown and gray, giving the characteristic salt-and-pepper mottling common to members of the genus. General structure typical for genus. Seventh sternite with a short, pointed, mesal process on apical margin.

Genitalia as in figure 36. Ninth segment with baso-lateral lobes short and rounded. Ninth sternite with its apico-lateral margins bearing a long, upper brush of long, stout setae and below this a projection bearing a cluster of shorter setae; from the ventral view this latter looks like a distinct appendage. Tenth tergite declivous and short, each caudo-lateral angle produced into a short, upturned hook, between which is a membranous area. Claspers apparently fused on meson, except at apex; each clasper has the mesal lobe short, beak-like and recurved at apex, and has the lateral margin produced into a long, finger-like lobe, twisted at right angles to "beak," bearing at its apex a long seta; the central portion of the clasper has a few sparse setae, the two combined forming a spatulate structure. Aedeagus long, the base flaring, the constricted portion encircled one and one-half times by a spiral process which is stout at its junction with the aedeagus but rapidly becomes thread-like. Apical portion of aedeagus vasiform above spiral, then divided into a long, stout, blade-like piece which is apparently semiflexible near its middle, and a tubular piece which is slightly shorter than the blade and which bears the penis. Apparently attached to the vasiform portion is a furcate, sclerotized rod whose function is yet unknown.

Female. Length 4.5 mm. Color and general structure as for male. Eighth segment with ventral side narrowed, its apex divided down meson by a narrow fissure, on either side of which is formed a lobe bearing three stout setae; lateral margins declivous. Dorsal portion of segment produced as a hood-like, sclerotized lobe into the seventh segment. Bursa copulatrix and ninth and tenth segments typical for genus.

Holotype.—Male; Huntsville, Utah; June 23, 1938; (Hardy & Stains).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—1 ♂, 11 ♀; Estes Park, Colorado; July 25, 1938; (H. H. & J. A. Ross). 2 ♂, 1 ♀; Grand Lake, Colorado; July 24, 1938; (H. H. Ross). 6 ♂; Belton, Montana; July 10, 1940; (H. H. & J. A. Ross; ex light globe). 4 ♂, 4 ♀; same data as for holotype. 1 ♂; Buffalo, Wyoming; June 21, 1940; (H. H. & J. A. Ross).

Paratypes are in the collection of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Hydroptila berneri new species (Pl. IV, fig. 38.)

This species is most closely related to *perdita* Morton, differing from it in the heavily sclerotized, sickle-shaped apex of the aedeagus.

Male. Length 3.3 mm. Color the common salt-and-pepper combination from the related members of the genus. General structure typical for genus. Dorsal sense caps of the head large, meeting on meson and together occupying one-half of the dorsal area of the head between the eyes. Seventh sternite with only a minute, apico-mesal projection.

Male genitalia as in figure 38. Ninth segment short, the invaginated portion elliptic, the dorsal portion merging with the tenth tergite, the lateral portion produced into a broad lobe which covers the base of the claspers. Tenth tergite long, vasiform, membranous, except for the sclerotized lateral margins, the apex divided into a pair of outcurved, pointed lobes and a small, finger-like, mesal projection. Claspers long, seen from the side; they taper regularly from base to apex, with the apical margin slightly reflexed laterad; from the ventral view, they have an irregular basal portion, from the lateral portion of which arises the main stem of the clasper which is of fairly even thickness throughout, slightly sinuate, armed with scattered setae on the apical two-thirds, the extreme apex more heavily sclerotized and reflexed laterad, and the apex of the two claspers almost meet on the meson. Aedeagus narrow throughout, the base considerably longer than the apex, flared at extreme base; the neck is short and bears only a short, inconspicuous spiral which encircles the neck only slightly more than once; articulating through a definite suture and joint with the neck is the apical portion which is heavily sclerotized, made up chiefly of a long, curved, sickle-shaped piece at the base of which is a small, foot-like shelf.

Female. Size, color, and general structure as for male. Genitalia as in figure 38B. Eighth segment slightly bulbous at base and cylindrical, the apex of the tergite with a deep, U-shaped incision on either side of which is a row of about four setae, the apex of the sternite produced into a large rounded lobe below which is an irregular crescentric row of about ten setae. Bursa copulatrix typical for the genus.

Holotype.—Male; Santa Fe River, Alachua County, Florida, March 4, 1939; at light; (L. Berner).

Allotype.—Female; same data as for holotype; [INHS].

Paratype.—1 ♂; same data as for holotype; [INHS].

Hydroptila strepha new species (Pl. V, fig. 40.)

This species is most closely related to the preceding, differing from it in the stouter aedeagus and style-like claspers.

Male. Length 3 mm. Color and general structure, including the apicomesal point of the seventh sternite, as for the preceding species.

Male genitalia as in figure 40. Ninth segment annular, the invaginated portion round; the dorsal portion is produced into an emarginate projection over the base of the tenth and the apex of the venter is produced laterally into a short lobe over the base of the claspers; the ninth segment thus has an evenly rounded, apico-lateral margin. Tenth tergite composed of a pair of sclerotized plates which diverge at apex, the portion between them filled with membranous folds. Beneath the tenth tergite arises a pair of very slender filaments. Claspers widely separated, the base somewhat plate-like and bearing a single, strong, dorsal seta where it tapers abruptly to form a apical portion; this is finger-like and tapers to base, is clothed with a sparse scattering of short setae, and the two diverge markedly. Subgenital plate short, with an apical thickening and a pair of setae near apex. Aedeagus with the base tubular, slightly irregular and equal to the length of neck and apex together; neck twice as long as wide, with a short spiral encircling it one and one-half times and with the large apical area of the lateral aspect membranous; apex consisting of a somewhat foot-like base and a long, slightly curved, slender, apical portion.

Holotype.—Male; along Susquehanna River, Athens, Pennsylvania; August 5, 1937; (J. H. Eddleson).

Hydroptila nicoli new species (Pl. VI, fig. 39.)

This species is readily separated from *acadia,* its closest relative, by the two pairs of blade-like projections of the tenth tergite.

Male. Length 2.3 mm. Color the typical salt-and-pepper combination of brown and gray, typical of this group. General structure typical for genus. Sensory caps of the head with their anterior margin rounded, meeting on the meson when retracted. Remaining dorsal portion of head with the posterior margin incised on each side of the meson to form a sharp mesal point. Extensile sensory lobes clothed with flat, ovate scales as illustrated for *acadia.* Seventh sternite with only a minute mesal projection. Eighth tergite small and reduced on the meson to a bridge of moderate width. Eighth sternite large and scoop-shaped, extending beyond the body of the genital capsule and clothed with very long, dense hair.

Genitalia as in figure 39. Ninth segment completely retracted within eighth, the base of each lateral lobe very wide and ending abruptly, the dorsal portion reduced to a very narrow connecting point bearing a stout, button-like sclerotization. Tenth tergite with a basal portion which is membranous in the center, has a sclerotized band down each side, is sharply upturned just beyond base and bears at the apex two pairs of movable blades. The dorsal pair is shorter and slightly bulbous at base, the ventral pair is longer, diverges less and is more nearly straight sided. Claspers long, dorso-ventrally flattened, tapering from near middle to near apex, with the tip bearing a dorsal and lateral point, the lateral margin with a scattering of fairly long setae. Aedeagus with the basal portion curved and robust, tapering suddenly to a narrowed portion which joins with the neck; neck short, scarcely swollen, and bearing a short, thin, spiral process; apical portion almost straight, widened near middle, its only ornamentation the internal penis tube.

Female. Similar in size, color, and general structure to male. Genitalia as in figure 39. Eighth sternite sclerotized and robust, widest at base, tapering slightly to apex, the apical margin forming a wide, evenly rounded, arcuate lobe which bears a few scattered setae. Eighth tergite also sclerotized, its apical margin emarginate as much as the sternite is produced; this emargination consists of a wide one embracing the entire width of the segment and an abrupt mesal one embracing only a third of the width of the segment; on either side of this latter are a few scattered setae. Bursa copulatrix short and robust, in general structure typical for genus.

Holotype.—Male; Gold Mine Brook, Moser River, Nova Scotia; July 29, 1939; (J. A. C. Nicol).

Allotype.—Female; same data as for holotype; [INHS].

Paratype.—3 ♂, 3 ♀; same data as for holotype.

Paratypes are in the collection of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Loxotrichia glasa new species (Pl. IV, fig. 28.)

This species is closely related to the Mexican *dalmeria* Mosely, but differs from it in the bifid lateral appendages of the ninth segment and other details of the genitalia.

Male. Length 3 mm. Color medium brown, the antennae white with a group of segments near the apex banded with black hair and the legs pale yellow. General structure typical for genus, including presence of ocelli, wing venation, and spur count of 0–3–4.

Genitalia as in figure 28. Eighth segment triangular, the ventral portion scoop-shaped and the dorsal portion forming a heavily sclerotized hump bearing a cluster of long setae at its apex; from this hump arises a heavily sclerotized pair of lateral arms, the base of each being within the eighth tergite, progressing posteriorad and curving dorsad, the apex incised to make a pair of sharp points. Ninth segment with ventral portion very long, invaginated through the eighth and into the seventh segment. The entire structure forms a sort of basket, the "handle" joined beneath the hump of the eighth tergite and the bottom of the basket formed by the long, rounded, ventral portion. Tenth tergite moderately sclerotized and beak-like. The apex of the eighth tergite is incised to form a wide "V" upon which the slightly emarginate ninth segment protrudes, and above this are seen a pair of inconspicuous short lobes, obliquely truncate at apex and separated by a rounded incision. Aedeagus with a short, enlarged, basal portion, a long, narrow, sinuate neck and an irregular enlarged apex; this apex is made up of a sinuate, sclerotized blade which is suddenly narrowed and twisted at apex, set in a membranous matrix which bears a pocket of flattened setae.

Holotype.—Male; along Honey Creek, Turner Falls State Park, Oklahoma; June 2, 1937; (H. H. Ross).

Family PSYCHOMYIIDAE

Phylocentropus placidus (Banks)

PENNSYLVANIA: Poyntelle; June 17, 1904, (M. Hebard), 1 ♂, [ANSP].

Nyctiophylax vestitus (Hagen)

MAINE: Greenville; July 21–29, 1919, (F. Haimbach), 1 ♂, [ANSP].

Genus POLYCENTROPUS

A study of accumulated material belonging to the *confusus* group has brought to light some interesting differences in the male genitalia which help to separate the species more definitely. The five species comprising the group are characterized by the elongate claspers bearing a baso-dorsal erect appendage as in figures 42–55, and the males may be separated from each other by means of the key which follows.

Key to Polycentropus confusus Group

1. Base of claspers large, almost as long as the attenuated apical portion, (Fig. 47)..**centralis** Banks
   Base of claspers much shorter than attenuated apical portion, (Figs. 45, 48)..2
2. Ninth sternite narrow; cerci with a finger-like projection from latero-caudal margin, (Fig. 45).........................**pentus** new species
   Ninth sternite wide; cerci without a finger-like projection from latero-caudal margin, (Fig. 46)...3
3. Baso-dorsal appendage of clasper almost sessile, without a definite stalk, (Figs. 46, 53) and projecting laterad of clasper, (Fig. 50); clasper concave along its dorso-lateral face, (Fig. 46)........**confusus** Hagen
   Baso-dorsal appendage with a definite stalk so that the dark mesal point is some distance from the basal part of the clasper, (Figs. 54, 55) and not projecting laterad of clasper; clasper concave along its dorso-mesal face, (Fig. 48)..4
4. Baso-dorsal appendage of clasper with a sub-triangular apex well differentiated from stalk, (Fig. 55)..................**maculatus** Banks
   Baso-dorsal appendage with apex smaller and merging gradually with stalk, (Fig. 54).................................**carolinensis** Banks

In addition to the characters mentioned in the key, those of the cerci, aedeagus and other parts offer differences valuable in diagnosis. The types of *centralis, carolinensis* and *maculatus* have been studied: figures 48, 54 are drawn from the type of *carolinensis*.

Polycentropus confusus Hagen (Pl. VI, fig. 42; pl. VII, figs. 46 & 53.)

The type male of this species in the Museum of Comparative Zoology lacks the abdomen. The characters for the species have therefore been drawn from a male thus identified by Mr. Nathan Banks and which agrees in external characters with Hagen's type.

Plesiotype.—Male; Capens, Maine; July 11, 1907; (C. W. Johnson); [In the collection of the Museum of Comparative Zoology, Cambridge, Massachusetts].

Polycentropus pentus new species (Pl. VII, figs. 45, 49, 50, 51.)

This species most closely resembles *confusus* Hagen, but differs in the mesal concavity of the clasper, the narrow ninth sternite, different shape of the aedeagus, and other characters of the male genitalia.

Male. Length 8.5 mm. Color chiefly brown, the eyes almost black, dorsum of head and thorax mottled with dark and light shades of brown, venter and most of legs light brown to straw color and wings with a few light flecks along the periphery. General structure and venation typical for genus.

Male genitalia as in figure 45. Eighth segment cylindrical with the sclerites unmodified. Ninth sternite narrow but deep, its depth considerably more than twice its length. Tenth tergite membranous with a pair of apico-ventral, finger-like, sclerotized lobes, each tipped with one or two fine setae. Cerci deep but narrow, the middle of the latero-caudal margin produced into a triangular tooth with lower projections above and below it; the meso-caudal margin straight and unmodified, extends slightly ventrad of the latero-caudal margin; the dorsal portion of the cercus is produced into a long, sclerotized rod which curves first upward, then caudad, then ventrad, as in the illustration, and bears a few fine setae near tip; the body of the clasper bears scattered setae on its lateral face. Claspers with a baso-dorsal, subtriangular, concave appendage which is clothed with long setae and has a cluster of micro spinules on the mesal angle; the body of the clasper consists of a short base and a long, scoop-like projection which is concave on the mesal face but completely convex on the outer face as seen from the side. The baso-dorsal appendages project laterad of the claspers when viewed from beneath, figure 50. Aedeagus composed of a sclerotized tube shaped as in figure 49, with an eversible, membranous sack at the apex and with a rounded ventral lobe near the base.

Female. Size, color, and general structure same as for male. Eighth, ninth, and tenth segments typical for genus in general structure; lateral flaps of the eighth sternite narrow and long, lanceolate, with a few scattered setae, those at the apex long; subgenital plate large, extending beyond lateral flaps and evenly arcuate at apex.

Holotype.—Male; Thunder Bay, Ontario; July 1, 1937; (H. S. Parish).

Allotype.—Female; Costello Lake, Algonquin Park, Ontario Fisheries Research Laboratory; June 2, 1939; (W. M. Sprules; cage #1); [INHS].

Paratypes.—1 ♂; Tuckerman's Ravine, Mt. Washington, New Hampshire; June 22; (P. J. Darlington). 5 ♂; same data as for allotype: 8 ♀; same data, but June 4: 1 ♂, 3 ♀; August 19: 1 ♂; June 6: 2 ♂, 1 ♀; June 3: 2 ♂, 1 ♀, June 11.

Paratypes are in the collections of the Illinois Natural History Survey, The Academy of Natural Sciences of Philadelphia, and the Museum of Comparative Zoology.

Polycentropus cinerea (Hagen)

MARYLAND: 1 ♂, [ANSP].
PENNSYLVANIA: Roxboro, June, 1914, 1 ♂, [ANSP].

Polycentropus nascotius new species (Pl. VI, figs. 41 & 44.)

The emarginate claspers differentiate this species readily from other members of the genus. It is most closely related to the *remotus* and *albipunctus* group as shown by the short lobes of the tenth tergite and the sclerotized and hook-like processes attached to the tenth segment. These two species, however, have the claspers semiovate, quite unlike the emarginate claspers of the present species.

Male. Length 5.5 mm. Color of entire venter very pale brown, some portions tending to whitish; upper portion of head and body and both pairs of wings appearing medium brown, the wings without markings and clothed with uniform brown hairs. Palpi and antennae pale brown. General structure typical for genus, including length of antennae, spur count, and wing venation. Hind wing with very indistinct cross-vein setting off discal cell, but with no cross-vein between Cu_2 and 1st A; on this basis it would normally be placed in the group containing *Plectrocnemia.*

Genitalia as in figure 41. Eighth sternite and tergite simple. Ninth tergite membranous, ninth sternite somewhat ovate, sclerotized and partially retracted within the eighth. Tenth tergite marked off from ninth by membranous ridges. It consists chiefly of a wide, membranous, mesal portion flanked at each side by a rather thin sclerotized plate which is broad from lateral view, bears a dorsal line of very fine hair, and has near the apex a single large, stout spine directed dorso-laterad. Cerci only entirely sclerotized, bearing a few scattered setae with a row of extra-long ones on the apico-dorsal margin. Attached on the inner margin of the base of the cerci are a pair of narrow lobes which project below the cerci and form dark sclerotized points. From the base of the tenth tergite near the ventral boundary of the cerci arise another mesal pair of sclerotized processes which curve caudo-mesad and ventrad and are hooked sharply at their apex into a sclerotized point.

Claspers emarginate at apex, to form a ventro-mesal lobe and a dorso-lateral lobe. From the former there arises just above base a small mesal lobe which bears a line of fine setae on its mesal margin. The dorsal lobe is produced mesad into a thick ridge which bears on its mesal margin a row of peg-like setae. Aedeagus tubular and simple, the dorsal margin incised before apex and the apical portion slightly membranous; ventral corner apparently armed with a pair of inconspicuous lobes, each bearing a seta. General outline as in figure 44; retractile parts and penis not exserted but shown roughly in dotted outline.

Holotype.—Male; Hubbard, Nova Scotia; August 22, 1939; (T. H. Frison & T. H. Frison, Jr.). [Wings on I.N.H.S. slide no. 13315.]

Paratypes.—1 ♂; Hampton, New Brunswick; August 20, 1939; (T. H. Frison & T. H. Frison, Jr.). 2 ♂; same data as for holotype. 1 ♂; Namakagon River, Hayward, Wisconsin; August 31, 1939; (B. D. Burks).

Paratypes are in the collections of the Illinois Natural History Survey and the Academy of Natural Sciences of Philadelphia.

Polycentropus charlesi new species (Pl. VII, fig. 56.)

This species is most closely related to members of the *adironica* group but is much simpler in structure than any described to this date. The narrow clasper with large basal protuberance, the produced ninth sternite, and the simple aedeagus will serve to distinguish this species from any of its congeners.

Male. Length 7 mm. Dorsum of head and body dark brown; ventral portion, legs, and antennae varying shades of light brown. Wings dark, except for scattered light splotches on the forewing. General structure typical for genus including spur count and body sclerites. Front wings, modified as follows: crossveins r, r–m, and m interstitial and forming a cord; R_{2-3} running very close to R_1 and branched very close to margin of wing; median cell very narrow and its base angulate; and many other differences as can be seen by comparing the wing of this species with that of the above. The hind wing is incomplete, but differs markedly in the relative size of the basal anal cells.

Male genitalia as in figure 56. Eighth segment with sclerites simple and small. Ninth sternite large, the apical margin produced into a mesal tongue, flanked at the base by sinuous lobes. Tenth tergite consisting of a wide, membranous, central portion flanked on each side by a sclerotized, blade-like lobe clothed at apex with scattered, long setae. Cerci large and robust, broad and rounded dorsally and merging into a large, ventral, sclerotized hook; this hook is clothed with relatively dense, fine setae, and the two hooks almost meet on the meson. Claspers, as seen from the side, incised to form a large, flat, somewhat club-shaped, dorsal lobe and a small, rounded, ventral lobe; the dorsal lobe is clothed with a scattering of medium length setae and bears a stout spine at apex and another one just basad of it; the ventral lobe is clothed with a scattering of moderate length setae and bears on its meso-dorsal margin a stout spine. Aedeagus shaped as in figure 56B, consisting of an irregular sclerotized tube which contains eversible, membranous folds and, among them, a long, sinuate and a short, straight, sclerotized rod.

Holotype.—Male; San Felipe Springs, Del Rio, Texas; April 19, 1939; (H. H. & J. A. Ross). [Wings on I. N. H. S. slide no. 13316.]

Polycentropus iculus new species (Pl. VII, fig. 58.)

This species is most closely related to *remotus* Banks, but differs from it in the different shape of the tenth tergite, claspers, and other parts of the genitalia.

Male. Length 9 mm. Dorsum of head and body dark brown; antennae, lateral and ventral portions of body and legs pale yellowish-brown. Wings with the ground color smoky, the front pair with areas of dark brown and almost white hair which give an irregular spotted appearance. General structure typical for genus. Cell R_2 present and petiolate in both wings, although in the hind wings R_2 is very faint in some specimens. Lateral crossvein enclosing discal cell present in some specimens, faint in others, absent in others. Media with only two branches in the hind wings.

Genitalia as in figure 58. Ninth sternite almost as deep as long. Ninth tergite represented by a series of membranous folds. Tenth tergite represented by an inconspicuous sclerotized band embedded in membranous folds, from each of which arises a sclerotized lobe with a wide base, a stout curved dorsal process from the apex of which protrudes a stout spine, and a shorter, more slender, ventral process from the apex of which arises a stout seta. Cerci broad, the apical margin produced into an orbicular lobe; from the meso-ventral corner of the cerci, there arises a broad hook with a sclerotized point; from the ventro-lateral corner of the cerci, there arises a sclerotized strap which runs mesad of the first hook and then angles sharply caudo-ventrad to form a second sclerotized hook. Claspers with the dorsal margin slightly concave, the ventral and caudal margins forming a wide, evenly rounded, junction and the apex narrow but rounded; the mesal margins are close together; there are two recurved flaps on the mesal face, one in the middle of the dorsal margin which is finger-like but small, appressed to the surface of the clasper, and one which rises from the caudo-ventral corner and which is essentially a thickening of that portion of the clasper. Aedeagus composed of a more or less sinuate tube, pointed at base, widest near base and tapering to apex, the apex itself divided into a pair of heavily sclerotized, forcep-like lobes between which projects a membranous central portion.

Female. Similar in size, color, and general structure to male. Genitalia as in *remotus*. Eighth tergite simple. Eighth sternite divided into a pair of short, wide lobes. Ninth and tenth segments simple, typical for group. Bursa copulatrix semisclerotized, composed of two pairs of plates closely attached to the inner surface of the ninth sternite to which is attached a small, vase-like terminal structure.

Holotype.—Male; Grand Lac Jacques Cartier, Laurentides National Park, Province of Quebec; July 11, 1938; (V. D. Vladykov).

Allotype.—Female; same data as for holotype, but July 5; [INHS].

Paratypes.—1 ♂; same data as for holotype, but July 8; 1 ♂; same data but July 4.

Paratypes are in the collections of the Illinois Natural History Survey and the Academy of Natural Sciences of Philadelphia.

Polycentropus colei new species (Pl. VII, fig. 57.)

This species is most closely related to *iculus,* differing from it in the unique tridentate dorsal portion of the aedeagus and the short, quadrate clasper.

Male. Length 9.5 mm. Dorsum of head and body light brown, with dark brown and whitish hair; lateral and ventral portion straw color with tawny and light brown hair; wings with ground color tawny upon which is superimposed an irregular pattern of medium brown markings. General structure similar to *iculis.*

Genitalia as in figure 57. Eighth tergite large and somewhat triangular. Eighth sternite small and somewhat rectangular. Ninth sternite twice as high as long, the invaginated portion short and rounded. Ninth tergite membranous. Tenth tergite composed of a narrow, basal, sclerotized band overlaid with membranous folds, and a pair of widely separated, lateral, sclerotized hooks, each of which has a broad base, a small, lateral, hook-like spur and a stout, curved, mesal projection with a spine set in the apex. Cerci large and auriculate, the mesal margin emarginate to form broad dorsal and ventral lobes, the lateral margin produced into a wide "V" and set with an irregular row of long setae. Claspers short and quadrate, with a dorsal projection which is thin and flat, with a saw-like row of spicules on the mesal margin. Aedeagus consisting of an irregular semimembranous tube at the apex of which is a long, dorso-mesal, blade-like projection; the blade itself is clothed with appressed flat setae and the portion of the aedeagus basad of it with short, irregular, curved setae; from within tube extends a pair of sclerotized rods which project under and on each side of the mesal blade.

Holotype.—Male; Glum Cave Trail, 4200 feet elevation, Smoky Mountain National Park, Tennessee; June 17, 1939; (A. C. Cole, Jr.; at light).

Cernotina astera new species (Pl. VII, fig. 59.)

This species is most closely related to *spicata* Ross, but can be distinguished from it by the abrupt division between base and apex of the cerci.

Male. Length 4.5 mm. Head, body, and appendages straw color, the wings, tibiae, and tarsi with brown hairs. General characteristics, including venation, spur count, structure of mouthparts, etc., typical for genus.

Genitalia as in figure 59. Ninth sternite triangular and mostly invaginated into the eighth segment. Ninth and tenth tergites fused, their apex divided by a deep, wide, arcuate emargination, produced into a pair of lateral lobes which are widely separated. Cerci with base broad, tapering suddenly to a short, rounded apex, the tips of the two overlapping slightly; the basal portion is clothed with long, scattered setae, the apex apparently destitute of vestiture. Beneath the tenth tergite lies a short, stocky, setate lobe.

Claspers with a long, dorsal process bearing a cluster of long slender spines at apex; main trunk with dorsal surface almost straight, ventral surface slightly curved, apex with a deep, narrow notch and outer face covered with scattered setae of medium length, with a row of especially long ones on the dorsal margin. Aedeagus tubular.

Female. Length 5 mm. Color and general structure typical for genus. Genitalia apparently identical with those of other members of the genus.

Holotype.—Male; San Felipe Springs, Del Rio, Texas; April 19, 1939; (H. H. & J. A. Ross).

Allotype.—Female; same data as for holotype, [INHS].

Paratypes.—6 ♂; same data as for holotype.

Paratypes are in the collections of the Illinois Natural History Survey and the Academy of Natural Sciences of Philadelphia.

This brings to six the number of species in the genus, all of which are apparently identical except for genitalia and slight differences in size. The key given below will serve to point out the distinguishing characters of these.

Key to Males of Nearctic Species of Cernotina

1. Cerci with three or four long, black teeth on mesal side near base **calcea** Ross
   Cerci without long, black mesal teeth................................2
2. Cerci with apical portion short and stout, ending in a short point, not overlapping on meson.................................**oklahoma** Ross
   Cerci with apical portion long and slender, overlapping on meson, fig. 59A...3
3. Apex of cerci long and ribbon-like the inner margin just beyond apex set with a row of five to seven small teeth............**pallida** (Banks)
   Apex of cerci shorter and whip-like, the inner margin without teeth....4
4. Apex of cerci much shorter than base, the two set off very abruptly, fig. 59...**astera** Ross
   Apex of cerci longer than base, the two merging into each other gradually...5
5. Base of clasper with a sclerotized, ovoid plate attached underneath it **spicata** Ross
   Base of clasper without this plate..........................**ohio** Ross

Tinodes consueta McLachlan

The following is a new state record. This species has been recorded previously only from California.

ARIZONA.—Huachuca Mountains; August, 1905, (H. Skinner), 1 ♂, [ANSP].

Family HYDROPSYCHIDAE

Arctopsyche grandis (Banks)

W[ASHINGTON] T[ERRITORY]: 17♂, [ANSP].

Diplectrona modesta Banks

PENNSYLVANIA: Saw Creek, Monroe Co.: May 19, 1935, (W. J. Harmer), 1 larva, [ANSP].

APHROPSYCHE new genus

Characters of the genitalia and venation place this genus in the *Diplectrona* group, which is a transitional one between the *Arctopsyche* group and *Hydropsyche* and its allies. From *Diplectrona,* its closest ally, this species may be separated by its convex vertex, straight radial veins in the hind wings and the prognathoid position of the head.

Characteristics.—General structure typical for family. Head somewhat prognathoid, the eyes wide apart and situated a considerable distance from back of head. Antennae short and moderately stout, with second segment only half length of first and of same thickness as flagellum. Dorsum of head convex, with mesal ridges inconspicuous and postero-lateral warts large. Pronotum with mesal pair of warts large and close together. Wings (fig. 60), both of nearly the same shape, evenly rounded at apex, venation generalized and typical for group.

GENOTYPE: *Aphropsyche aprilis* new species.

Aphropsyche aprilis new species (Pl. VIII, fig. 60.)

Male. Length 10 mm. Head with eyes blackish, dorsum dark brown except for the lighter colored lateral warts, ventral portion pale straw color, antennae straw color with very narrow, brown annulations. Dorsum of thorax and abdomen medium to dark brown, venter of both and all parts of the legs straw colored. Wings uniformly yellowish-brown. General structure as given for genus.

Genitalia as in figures 60A and 60B. Eighth tergite with a conspicuous transverse crease just before apex; eighth sternite much smaller than tergite and quite regular in outline; the membranous band connecting the eighth and ninth segments very wide dorsally. Ninth segment partially retracted within the eighth; the dorsal part forms a rounded, dark cushion which is joined to the lateral and ventral portions by a narrow bridge; the lateral portion forms a small triangle almost entirely invaginated within the eighth segment, and the ventral portion projects as a thin, arcuate lobe. Claspers long, filiform, and indistinctly, if at all, segmented, clothed with relatively short setae which become more abundant towards the apex. Tenth tergite large and deep, forming a rounded cushion separated from the ninth by fairly well-marked furrows; it is divided by a well-marked fold into an unornamented basal portion and apical cushion bearing scattered short setae and produced latero-ventrad into a dark, sclerotized, up-turned spur. Aedeagus complex; the entire organ is angled sharply to form a basal and apical part. The upper sclerotized piece is complete throughout the entire "V," but at the bend is divided into two stout, sinuous arms which terminate within the bulbous apex of the ventral part. The lower piece is sclerotized only beyond the bend, and basad of this point is represented by membranous folds; it is enlarged at the apex into a round, hollow spoon. Connected with the lower portion is a simple tube; it has the base membranous, the main portion cylindrical with a pair of stout, latero-dorsal, sclerotized barbs towards apex, apex itself tapering to a narrow but truncate tip, this median appendage bears the true penis through a central canal.

Holotype.—Male; Parksville, Tennessee; April 25, 1938; (Ross & Burks). [Wings on I. N. H. S. slide 13308.]

OROPSYCHE new genus

This genus is closest to *Aphropsyche* Ross, but is readily distinguished from it and allied genera by the curious emarginate apical margin of both wings (Fig. 61).

Characteristics.—General structure typical for family. Head distinctly prognathoid, eyes far apart and situated a considerable distance from back of head. Dorsum of head slightly convex, mesal ridges low and inconspicuous, postero-lateral warts medium sized, oval and situated diagonally. Antennae moderately slender but short, first segment large, twice as long as wide, second segment half length of first and more slender, flagellum more slender than second segment. Pronotum with mesal warts large and approximate. Wings essentially the same shape, broad and short, with apical margin emarginate. Venation typical for group.

GENOTYPE: *Oropsyche howellae* new species.

Oropsyche howellae new species (Pl. VIII, fig. 61.)

Characters to separate this species from other described forms have been given under the generic description.

Male. Length 13 mm. Color varying shades of light brown, the ventral portions approach yellowish-brown to yellowish; the flagellum has a dark annulation around the basal eleven segments, in each case situated above the center of the segment; wings chocolate brown with small flecks of pale brown scattered irregularly over the entire surface but more numerous in the apical region. General structure as given for genus.

Genitalia as in figure 61. Ninth segment greatly constricted in middle to form a somewhat detached ventral portion with which the claspers articulate and a small triangular dorsal portion separated from the tenth tergite by a crease. Tenth tergite very deep, extending almost to the base of the aedeagus but relatively narrow so that from the caudal view it is shaped like a long wedge; most of the dorso-lateral part is occupied by an ovoid, membranous wart covered with a scattering of setae; the extreme apex is incised on the meson to form a pair of short, blunt lobes whose apical margin is covered with a row of rather dense, short setae. Claspers curved, slightly wider at the base, clothed with scattered setae over their entire area and, in addition, with a cluster of long setae around the apex; the second segment is differentiated by indistinct folds only as an indefinite area at the extreme apex. Aedeagus with stem slender and angled at base, produced into a long, upturned apex; at the base of this apical portion arises a membranous, extensile stock bearing a sclerotized structure as shown in the illustrations.

Holotype.—Male; below dam, East Fork Tuckaseegee River, Wolf Mountain Lumber Company Club House, Jackson County, North Carolina; June 12, 1939; (Thelma Howell). [Wings on I. N. H. S. Slide 13309.]

Cheumatopsyche pettiti (Banks)

W[ASHINGTON] T[ERRITORY]: 1 ♂, [ANSP].

Cheumatopsyche campyla Ross

NEW YORK: Ithaca; June 17, 1936, 1 ♂, [ANSP].

Cheumatopsyche oxa Ross

Previous records of this species are from Michigan and Indiana. This extends its known westward range considerably.

ARKANSAS: Five miles north of Jasper, Newton County; Aug. 11, 1939, 1000 ft. alt., (Rehn & Rehn), 1 ♂, [ANSP].

Cheumatopsyche etrona new species (Pl. VIII, fig. 62.)

In general color markings, this species is remarkably similar to *speciosa* (Banks), but differs radically from it in the low lateral lobes of the tenth tergite and the wide distance which separates them. In structure, it is most closely related to *analis* (Banks), but differs from it in the deep apical incision of the tenth tergite.

Male. Length 5.5 mm. Color of head and body dark brown; antennae yellowish-brown at base, darkening towards apex, the four basal segments with a dark, dorsal V-spot; legs with tibiae and tarsi of front and middle legs and basitarsus of hind legs yellowish-brown; front wings with the ground color smoky brown with four large, light, clear areas, one near base, two just beyond middle, and the fourth on anterior margin midway between the central ones and the apex. General structure typical for the genus except for the front tibiae which either lack apical spurs or have them extremely reduced. They may be broken off but the rest of the specimen is in such perfect condition that there seems no reason to believe that this condition is the result of injury.

Male genitalia as in figure 62. Ninth segment annular, produced dorsad into a pair of lobes, each bearing an apical line of long setae. Tenth tergite declivous and more or less triangular seen from lateral view, separated from the ninth by a semi-sclerotized cord. Near this cord is a long, membranous wart covered with scattered but fairly long setae. The apical portion is semimembranous, the apical margin deeply incised on the meson to form a wide "U"; on each side of this is a low lobe bearing a few setae at apex and a short spine on the baso-lateral region. Seen from caudal view, these lobes are widely separated and are not greatly differentiated from the rest of the segment. Claspers with basal segment three times length of apical, slightly irregular on the basal two-thirds and expanded moderately at the shoulder, this latter bearing a cluster of very long setae in addition to the shorter ones clothing the entire segment; apical segment very narrow, the base narrow and tapering rapidly to an even narrower, long, style-like apex, the entire segment bearing only a few scattered, fine setae. Aedeagus with basal bulb not greatly enlarged but the entire structure typical of the genus.

Holotype.—Male; Lakemount, Georgia; June 30, 1939; (P. W. Fattig).

Cheumatopsyche mollala new species (Pl. VIII, fig. 64.)

This species is most closely related to *etrona,* but differs in the shorter and stouter apical segment of the claspers and in the high, sharp lobes of the tenth tergite.

Male. Length 9 mm. Head and body dark brown, approaching black; flagellum of antennae yellowish-brown, the six basal segments with a dark, dorsal V-mark; legs below coxae light yellowish-brown; wings dark brown, irregular flecking over most of the front wing of a shade of brown slightly lighter than the remainder. General structure typical for genus.

Male genitalia as in figure 64. Ninth segment cylindrical, the dorsal portion divided into two lobes bearing a line of long setae on their apical margins. Tenth tergite only indistinctly separated from ninth; at the apex is a pair of high, sharp, sclerotized processes, each of which is abundantly clothed with setae on the basal and central portions, and the two are widely separated on the meson. Near the center of the tergite is an irregular wart on each side; these warts are semimembranous and bear long, scattered setae. Seen from above, the apex of the tergite is wide with a narrow, tongue-like, mesal projection and a small incision on each side of it. Claspers with basal segment four times as long as apical one, the basal three-quarters narrow and relatively straight, the apical portion enlarged into a dorsal shoulder and bearing a group of long setae in addition to the shorter setae which cloth the entire segment; apical segment with the dorso-mesal surface strongly concave; its base is wide, and it tapers to a narrow apex, the entire ventral surface clothed with a scattering of fine setae with two or three short, stout setae at extreme apex. Aedeagus with base bulbous, typical for genus.

Holotype.—Male; Mollala River, Oregon; April 13, 1938; (S. G. Jewett, Jr.).

Cheumatopsyche pinaca new species (Pl. VIII, fig. 63.)

The general appearance links this species with *minuscula, oxa,* and other somber-colored members of the genus, but structurally, it is most closely related to *speciosa* (Banks). It differs from this latter species in a multitude of characters in the male genitalia, most conspicuous of which are the short, stockier apical segment of the claspers and the wide, setose, secondary flap of the lateral lobes of the tenth tergite.

Male. Length 7.5 mm. Color of head and body dark brown; antennae, with four basal segments of the flagellum, slightly lighter and bearing the dorsal V-marks; legs yellowish-brown below coxae, with a few darker brown marks at the base of the femora; wings almost uniformly dark brown, but the front ones having a few small, inconspicuous light flecks along the anterior and apical margins. General structure typical for genus, with the two apical spurs of the front tibiae about one-half as long as those of the middle tibiae.

Genitalia as in figure 63. Ninth segment annular, the dorsal lobes only moderately raised above the level of the rest of the segment. Tenth tergite with a raised, sclerotized band separating it from the ninth. Caudad of this is a small, lateral, setate wart; the apex is divided into a pair of curious lateral lobes which touch on the meson. Each lobe is composed of two plate-like disks; the apical one is now cephalad, lies almost flat upon the surface of the tergite, and is armed along the apical margin with a row of long, curved setae; the basal plate is now caudad, stands at almost right angles to the tergite, and bears along its dorsal margin a more irregular row of shorter setae. Claspers with the basal segment four times as long as apical one, very regular in thickness, enlarged only slightly at the shoulder which bears the usual cluster of long setae; apical segment more or less cylindrical, narrowing appreciably only beyond middle and armed with a scattering of fine setae. Aedeagus with the basal bulb only moderately enlarged and otherwise typical for the genus.

Female. Size, color, and general structure as for male. In color it resembles *oxa;* structural characters to separate the two have not yet been found.

Holotype.—Male; Atlanta, Georgia; May 7, 1939; (P. W. Fattig).

Allotype.—Female; Lynchburg, Virginia; April 20, 1938; (Ross & Burks); [INHS].

Paratypes.—1 ♂; along Mossy Creek, Perry; Georgia; May 13, 1939; (P. W. Fattig). 1 ♂; along Swannanoa River, Black Mountain, North Carolina; April 24, 1938; (Ross & Burks). 1 ♂, 4 ♀; same data as for allotype.

Paratypes are in the collections of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Cheumatopsyche burksi new species (Pl. IX, fig. 66.)

This species is most closely related to *enonis* Ross, but differs from it in the well-developed apical lobes of the tenth tergite. Superficially it might be confused with *campyla,* but differs from this and related species in the short, wide-based, apical segment of the clasper.

Male. Length 9 mm. Head and body various shades of medium to dark brown; antennae yellowish-brown, the five basal segments of the flagellum with a dorsal, brown V-mark; legs belows coxae straw-colored; front wings light brown with abundant light flecks over the entire surface and with two fairly large light areas along the anal margin, one at the end of the anal veins, the other near the conjunction of the anal veins. General structure typical for genus.

Genitalia as in figure 66. Ninth segment cylindrical, the apex divided into a pair of protuberances bearing an apical row of long setae. Tenth tergite set off from ninth by an indistinct, semi-sclerotized ridge; in the middle of the lateral aspect is a medium-sized wart bearing scattered, long setae; the apex is divided into lateral lobes, each one more or less elliptic from caudal view and bearing a scattering of setae of which the longer ones are toward the top. Claspers with basal segment regular, only slightly enlarged into a shoulder near apex, this area bearing a group of very long, scattered setae in addition to the short setae covering the entire segment; apical segment about one-fourth the length of the basal one, its base wide and with a small but distinct mesal corner, the segment tapering to form a very slender and finger-like apex, the setation of the segment consisting of a few scattered, minute setae on caudal face, a row of longer setae on mesal angle and one or two setae at extreme apex. Aedeagus only moderately enlarged at base and typical for genus.

Female. Similar in size, color, and general structure to male. Characters have not yet been found for distinguishing the female of this species from that of *campyla* and others of the same color.

Holotype.—Male; along Spoon River, Havana, Illinois; October 2, 1938; (B. D. Burks).

Allotype.—Female; Tavares, Lake County, Florida; March 23, 1936; (F. N. Young); [INHS].

Paratypes.—4 ♂; same data as for allotype.

Paratypes are in the collections of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Cheumatopsyche pasella new species (Pl. VIII, fig. 65.)

This species is most closely related to *campyla* Ross, but differs from it in the longer and narrower apical lobes of the tenth tergite which are held at an oblique angle and expose the mesal apex of the segment. In addition, the apical segment of the clasper is longer and, seen from the side, narrower.

Male. Length 7 mm. Color of head and body dark brown; antennae yellowish-brown, the four basal segments of the flagellum with a dark, dorsal V-mark; legs yellowish-brown; wings dark brown, with a few small, indistinct dots near apex and a single, larger but relatively indistinct mark near the anal angle. General structure, including venation and spur count, typical for genus. Spurs of front tibiae about half the length of the other apical spurs.

Genitalia as in figure 65. Ninth segment annular, subdivided dorsally into a pair of lobes fringed with very long setae. Tenth tergite separated from ninth by an inconspicuous fold and sclerotized ribbon; near its ventro-lateral angle is a small wart bearing a cluster of sparse setae; the apex is divided into a pair of long lobes held at an angle distinctly caudad and clearing the mesal apex of the segment These lobes, from caudal view, are wide at the base, taper gradually to the apex, and are appressed for a considerable distance at the apex; from the lateral view, they are either filiform or taper to the apex, are clothed with relatively sparse setae which do not form a bushy growth at apex Clasper with basal segment slightly less than three times as long as apical segment, appearing slightly constricted towards middle and with the apex forming an even but not greatly enlarged shoulder bearing a cluster of long setae; apical segment narrow, especially as seen from the side, sinuate, as in figure 65. Aedeagus as in figure 65, the basal bulb only moderately enlarged and the general shape typical for genus.

Female. Length, color, and general structure as for male, differing in being more robust and the usual antigenetic structures. Genitalia typical for the genus. To date no characters have been found to separate this species from others in the genus which have the same color.

Holotype.—Male; Pineville, Kentucky; June 24, 1938; (T. H. Frison and T. H. Frison, Jr.).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—70 ♂, 48 ♀.

GEORGIA: Calhoun; June 14, 1939, (P. W. Fattig), 1 ♂. 6 miles west of Concord; May 11, 1939, (P. W. Fattig), 2 ♂. Flat shoals on Flint River, 5.6 miles west of Concord; (P. W. Fattig), 1 ♂. Ringold; June 14, 1939, (P. W. Fattig), 2 ♂.

ILLINOIS: along Kaskaskia River, Venedy Station; August 27, 1940, (Mohr & Riegel), 1 ♂.

INDIANA: along Yellow River, Knox; May 24, 1937, (H. H. Ross), 1 ♂.

KENTUCKY: Same data as for holotype, 36 ♂, 1 ♀.

NORTH CAROLINA: along Catawba River, Statesville; April 23, 1938, (Ross & Burks), 1 ♂.

PENNSYLVANIA: along Susquehanna River, Athens; August 5, 1937, (J. H. Eddleston), 1 ♂.

TENNESSEE: Sevierville; June 11, 1938, (T. H. Frison and T. H. Frison, Jr.; at light), 23 ♂, 46 ♀.

WISCONSIN: along Totogatic River, Minong; September 3, 1939, (B. D. Burks), 3 ♂, 1 ♀.

Paratypes are in the collections of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Hydropsyche betteni Ross

PENNSYLVANIA: Homebrook, Lower Merion Township, Delaware Co., September 15, 1918, 1 ♂, [ANSP]. Swarthmore; July 10, 1910, (E. T. Cresson, Jr.), 1 ♀, [ANSP]. Philadelphia; July 11, 1911, (E. R. Casey), 1 ♀, [ANSP]. Lehigh Gap; July 13, 1900, 1 ♀, [ANSP].

Hydropsyche separata Banks

Little is known regarding the distribution of this species, recently described from New York. These records establish its range as definitely northern, with a wide east to west scope.

CANADA: Prince Albert; July 27, 1907, (H. Skinner), 2 ♂, [ANSP]; same but July 28, 1 ♂, [ANSP].

MONTANA: 4 ♂, [ANSP].

W[ASHINGTON] T[ERRITORY]: 4 ♂, [ANSP]

Hydropsyche delrio new species (Pl. IX, fig. 67.)

The deep lateral flanges of the aedeagus together with the peculiar shape of the aedeagus, seen from ventral view, separate this species from *orris* which it most closely approaches.

Male. Length 11 mm. Color various shades of light brown except for the eyes and "V" marks on the basal nine segments of the flagellum, which are black; legs and venter mostly straw color; front wings finely irrorate with brown and straw color over their entire surface, so that they have a salt-and-pepper mottling. General structure typical for genus. Eyes very small, seen from above, only slightly larger than the posterior warts.

Genitalia as in figure 67. Ninth segment annular, the lateral angle fairly sharp. Tenth tergite set off from ninth only by indistinct folds; it is divided into a pair of irregular and more or less ovate lobes, each bearing an oval area of scattered setae laterally and with a few scattered setae on the meson between them. Claspers with apical segment slightly more than three times length of basal segment; basal segment narrowest near base, enlarged slightly towards apex, the lower margin straight and the upper margin evenly sinuate, the entire lateral surface covered with scattered setae and the upper apical area bearing a small number of long, conspicuous setae; apical segment with upper margin sinuate, lower margin straight at base but curved evenly towards apex to form a slight hook, the surface of the entire segment covered with sparse, short setae.

Aedeagus angled near base, the horizontal portion of the stem sinuate, seen from the side, and constricted abruptly before apex when seen from below, but confluent with apex from both views. Apex very deep in proportion to its short length, lateral plate almost globular, the top of the lateral flange as high as the top of the mesal dome and without sharp angles. Ventral cavity large, occupying all of the apex except the narrow lateral and apical margin; it is almost completely closed ventrally by shelf-like projections of the lateral plates. Mesal plates produced into a moderate hump and appearing ovoid from ventral view.

Female. Length 12 mm. Color and general structure almost identical for male, including size of eyes. Female genitalia apparently identical with other members of the *scalaris* group.

Holotype.—Male; near San Felipe Springs, Del Rio, Texas; April 19, 1939, (H. H. & J. A. Ross).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—3 ♂; same data as for holotype.

Paratypes are in the collection of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Hydropsyche orris Ross

Previous records are from Illinois, Michigan and Wisconsin. The following is a new state record and extends the known range of the species considerably.

TEXAS: 1 ♂, [ANSP]

Hydropsyche demora new species (Pl. IX, fig. 68.)

On the basis of the open mesal cavity of the apex of the aedeagus, this species would be placed in the same group as *valanis* Ross from which it differs, however, in the thick lateral flanges of the aedeagus and the wide, round head of the aedeagus. It differs, also, from many members of the *scalaris* group in having the antennae entirely yellow without the characteristic black "V" marks.

Male. Length 10 mm. Body and appendages chiefly yellowish straw color, except for the eyes which are black, lateral areas on the mesonotum and meso- and metapleura which are a medium shade of brown and the front wings which are straw colored with a brown stigmal area and an irregular irrorate pattern of light brown on the apical one-third. General structure typical for genus; the eyes are large, each one equal in size to the space between them, when seen from above.

Genitalia as in figure 68. Ninth segment cylindrical, separated from the tenth by a V-shaped, slightly irregular fold, with a group of four or five long setae in the dorso-lateral cavity and with the lateral projection below the middle moderately rounded. Tenth tergite produced at the sides into a pair of irregular lobes, each bearing an area of scattered setae; the central portion of the tergite is dome-shaped with a group of scattered setae over most of it. Claspers long; basal segment is fairly uniform in thickness and forms only an inconspicuous swelling near apex, which swollen area bears a cluster of very long, scattered setae in contrast with the uniform scattering of shorter setae over the rest of the segment; apical segment slightly less than one-third length of basal segment, lower margin almost straight, evenly curved at apex, upper margin sinuate to produce a large basal area and a small, slightly up-turned, apical area; the division between the two segments is relatively inconspicuous. Aedeagus bent at nearly a right angle, the basal portion about one-half the length of the horizontal portion; apical head round, with a marked basal constriction, seen from below, and narrowing from the stem, seen from a lateral view; the lateral plates have a mesal notch and slightly overlap each other just beyond this notch, so that a rhomboidal opening is present between them; the apex of each lobe is rounded and the lateral flange is oblique, more or less regular sided, twisted slightly at apex. The ventral surface of the flanges is scarcely lip-like and therefore the ventral cavity is completely open, outlined only by the declivity of the flanges and forming a ventral pocket shaped something like a figure 8. Mesal lobes wide, not high, and appearing small and appressed from ventral view.

Holotype.—Male; Demorest, Georgia; July 1, 1939; (P. W. Fattig).

Hydropsyche placoda new species (Pl. IX, fig. 69.)

This species is most closely related to *scalaris,* but differs from it in the short apical segment of the claspers which are obliquely truncate at the tip.

Male. Length 10 mm. Eyes rusty-red, dorsum of head and body dark brown, venter and appendages yellowish, the antennae with fine, black "V" marks on the eight basal segments of the flagellum, wings in general tone light brown with an irregular flecking of almost white irrorations. General structure typical for genus. Eyes very large, each one equal in width to space between them and almost completely hiding the head from side view.

Genitalia as in figure 69. Ninth segment annular, the lateral angle rounded. Tenth tergite set off from ninth only by the declivity of the latter; it has a central, ovate area bearing a few scattered setae and at each side a blunt, lateral lobe also clothed with scattered setae. Claspers with apical segment four times length of basal one; basal segment sinuate, without a hump-like area at apex, clothed with scattered setae over its entire lateral surface and with a group of longer setae on the upper margin at apex; apical segment quadrate, the apex truncate and slightly oblique, the surface covered with very fine, short setae.

Aedeagus with a moderately sharp angle at base. The stem is slightly swollen near middle and from that point tapers gradually into the dome of the apex. Apex almost evenly rounded with a slight secondary hump at base but without marked constriction between apex and stem; lateral flanges very wide and touching at apex, oblique below, straight above, with the dorsal margin confluent with dorsum of both mesal dome and stem. Mesal cavity small, occupying only a small portion of the total area of the apex, and closed for two-thirds of its area on the venter by shelf-like projections of the lateral plates. Mesal plates produced forward into a conspicuous hump and appearing as ovate disks from the ventral view.

Female. Length 11 mm. Color and general structure typical for other members of the group, differing from the male in the small eyes and more mottled, darker wings. Genitalia apparently indistinguishable from those of other members of the *scalaris* group.

Holotype.—Male; along Namakagon River, Spooner, Wisconsin; June 5–6, 1936; (Frison & Ross).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—56♂, 13♀:

ILLINOIS: 1♂; Botanical Garden, Elgin; June 6, 1939; (Burks & Riegel). 1♂; Rainbow Springs; June 6, 1939; (Burks & Riegel). 1♂; Kankakee; June 12, 1931; (Frison & Mohr). 4♂; Starved Rock State Park; June 17, 1938; (Frison & Mohr): 6♂; June 18, 1938; (Ries & Werner): 5♂; June 15, 1938; (D. T. Ries): 1♀; June 28, 1937; (G. T. Riegel): 9♂, 1♀; June 28, 1937): 6♀; June 22, 1938; (D. T. Ries). 1♂; Sugar Grove; June 13, 1939; (Frison & Ross).

MINNESOTA: 6♂; Morrison County; August 16, 1938; (D. G. Denning): 4♂; Pine County; May 28, 1938; (H. E. Milliron).

NEW YORK: 2♂; Niagara Falls; September 1, 1939; (T. H. Frison & T. H. Frison, Jr.).

ONTARIO: 1♂; Niagara Falls; June 10, 1937; (Ries & Davis).

SOUTH DAKOTA: 1♂; Brookings; July 2, 1919; (H. C. Severin).

WISCONSIN: 14♂, 5♀; Namakagon River, Spooner; June 5–6, 1936; (Frison & Ross).

Paratypes are in the collections of the Illinois Natural History Survey, University of Minnesota, and The Academy of Natural Sciences of Philadelphia.

Hydropsyche fattigi new species (Pl. IX, fig. 70.)

This species is most closely related to *placoda* Ross, differing from it in the upturned, lateral flanges of the aedeagus and the round apex of the aedeagus.

Male. Length 9 mm. Color of body various light to medium shades of brown; antennae straw color with the dorsal dark brown "V" spot on the eight basal segments of the flagellum; legs almost entirely straw color with a few darker markings on the coxae; wings light brown and almost evenly covered with fine irrorations, with only a single moderate light spot near the anal angle. General structure typical for genus. Eyes small, separated by a distance equal to twice the dorsal width of one of them .

Genitalia as in figure 70. Ninth segment annular, the ventral portion strap-like, the lateral portion somewhat annulate and the dorsal portion flowing evenly into the tenth tergite. Tenth tergite incised on the meson to form a wide "V"; the mesal portion is clothed with scattered, medium length setae; the lateral portions are set off more or less distinctly as flap-like areas each bearing laterally a group of scattered setae. Claspers with apical segment only one-fourth the length of basal segment; basal segment narrowest near base, tapering gradually to form a slight apical shoulder, most of the segment clothed with medium length, scattered setae with a few long setae on the shoulder; apical segment trapezoidal, the ventral margin slightly concave, the apical margin almost truncate but slightly convex so that all corners of the segment are annular.

Aedeagus angled at base, the basal portion short and the stem almost cylindrical for most of its length, slightly expanded, then contracted, just before apex. Apex round, viewed from below, with the lateral plates separated by a "V" at apex; mesal cavity large and round, the flange-like projections of the lateral plates forming only a narrow shelf which covers only a small portion of the cavity; mesal plates small and triangular. From lateral view the lateral plates are held at a distinct angle to the axis of the stem; the lateral flange is produced upwards so that the plate appears truncate at apex and the apico-dorsal corner of the lateral flange is considerably dorsad of the mesal dome; mesal plates not hump-like but forming a relatively flat body.

Female. Length 10 mm. Color and general structure similar to male. Genitalia similar to other members of the genus; no diagnostic characters have yet been discovered to separate this female from the females of other species of the *scalaris* group.

Holotype.—Male; six miles west of Concord, Georgia; May 11, 1939; (P. W. Fattig).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—Apalachee River, 10 miles east of Monroe, Georgia; June 12, 1931, (P. W. Fattig), 1 ♂. Flat Shoals, Flint River 5.6 miles west Concord, Georgia; April 21, 1939, (P. W. Fattig), 1 ♂. Same data as for holotype, 3 ♂.

Paratypes are in the collections of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Hydropsyche phalerata Hagen

This is one of the more abundant Atlantic Coast species of the genus.

PENNSYLVANIA: Philadelphia; May 19, 1 ♂, [INHS].

Hydropsyche philo new species (Pl. IX, fig. 71.)

This species is closest to *occidentalis* but differs radically from it in the saber-shaped, curved, apical segment of the clasper.

Male. Length 12 mm. Color of head, thorax, and dorsum of abdomen brown to almost black; appendages varying shades of yellowish-brown with the following exceptions: "V" marks on nine basal segments of flagellum, irregular areas on femora, most of coxae common dark brown to black; wings brown with a very obscure irroration of lighter brown over the entire surface. General structure typical for genus. Eyes very small seen from dorsal view, only slightly larger than posterior warts.

Genitalia as in figure 71. Ninth segment cylindrical. Tenth tergite large, hood-like, and only indistinctly differentiated from ninth; it is divided by semimembranous, mesal folds into two large, lateral lobes, each bearing on its apical half an ovoid area of scattered setae and bearing on the meson and at the extreme tip an irregular area of scattered setae. Claspers with apical segment almost half the length of the basal segment; basal segment only slightly thickened towards apex, with scattered, short setae over the entire lateral area and with a cluster of longer setae on the upper margin near apex; apical segment large, with both upper and lower margins almost evenly concave and convex, respectively, the two meeting to form a tip which is slightly recurved, the entire segment covered with fine, scattered setae.

Aedeagus angled near base, the basal portion slightly angled again; the stem is slightly constricted near middle and enlarges evenly until it is widest near apex. Apex set off from stem rather abruptly below but the two forming a continuous, sinuate, dorsal margin. Lateral plates expanded abruptly, their mesal margins angulate, slightly overlapping, but separated at apex by a "V." The lateral flange is not greatly developed. Mesal cavity small, no greater than the apical region of either lateral plate, and open ventrally except for a very narrow shelving of the lateral plates. Mesal plates ovoid, and narrow from the ventral view.

Female. Length 12.5 mm. Similar in color and general structure to male, differing only in being more robust. Female genitalia apparently identical with others of the *scalaris* group except that they are suffused with dark brown. This, however, is not a difference which can be used for diagnostic purposes.

Holotype.—Male; Hastings Natural History Reservation, Monterey County, California; May 24, 1938; (C. D. Michener; at light).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—1 ♂, 4 ♀; same data as for holotype and allotype. Paratypes are in the collections of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Hydropsyche occidentalis Banks

This is an interesting southeastern record. The species is widely distributed throughout the western mountain region.

NEW MEXICO: Jemez Mts., 6400 ft. alt.; August 10, 1917, (J. Woodgate), 2 ♂: August 14, 1917, (J. Woodgate), 1 ♂: [ANSP].

Hydropsyche venada new species (Pl. IX, fig. 72.)

Closest to *protis* Ross but differs in various characters of the aedeagus, notably the long, dorsal, membranous area bearing a pair of short but stout sclerotized spurs at base.

Male. Length 11 mm. Color various shades of brown, wings brown, irrorate with light marks over the entire surface, typical of the *alternans* group. General structure typical for genus.

Genitalia as in figure 72. Ninth segment annular, ventral bridge short, lateral projection large and rounded and dorsal portion merging rather gradually with the tenth tergite. Tenth tergite with a sharp hump near base which is about the same height as the top of the ninth, and is clothed with short, scattered setae; apex produced into a pair of thin but deep processes slightly expanded at apex and clothed beneath with short, scattered setae; the ventro-lateral area bears a more or less circular setate raised area. Claspers with apical segment short, between one-third and one-quarter the length of the basal segment; basal segment tapering slightly to apex, clothed with short scattered setae over most of its area and with an additional cluster of longer setae on the dorso-apical shoulder; apical segment somewhat cone-shaped with rather close, small setae. Aedeagus sinuate, the base broad and making a very obtuse angle with the remainder. Dorsal plates ovoid; basad of these is a long, membranous area at the base of which is situated a pair of short but stout sclerotized spurs which almost meet on the meson; the extreme apex bears a central cluster of extrusible spicules and also a few scattered ones at the side. There are no long, lateral processes emanating from the aedeagus.

Holotype.—Male; Huachuca Mountains, Arizona; July; (H. A. Kaeber); [The Academy of Natural Sciences of Philadelphia, no. 9113].

Paratypes.—1 ♂; same data as for holotype. 1 ♂; Nevada; July 16–23. 2 ♂; High Rolls, New Mexico; April 24, 1939; (J. A. & H. H. Ross).

Paratypes are in the collections of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

This species was one of the few inhabitants of a small stream in the Guadalupe Mountain Range at High Rolls, which is just east of Alamogordo, New Mexico.

Hydropsyche oslari Banks

ARIZONA: Huachuca Mts.; July, (H. A. Kaeber), 2♂, 4♀: August, 1905, (H. Skinner), 1♂: July, 1907, (H. A. Kaeber), 1♂, 2♀, [ANSP].

Hydropsyche slossonae Banks

PENNSYLVANIA: Marshall's Creek, Monroe Co.; May 24, 1935, (W. J. Harmer), 26 larvae, [ANSP].

Hydropsyche ventura new species (Pl. IX, fig. 73.)

This species is most closely related to *slossonae* Banks, but may be readily separated from it by the curious, lateral, membranous appendages of the aedeagus. These appendages are more or less swallowtail like and quite distinct from all other nearctic species of the genus.

Male. Length 10.5 mm. Head, thorax and abdomen various shades of brown; legs straw color; antennae alternate bands of straw color and brown; front wings mottled and irrorate over the whole surface, as in other members of the group. General structure typical for genus.

Genitalia with ninth segment cylindrical, dorsum humped and caudolateral margin forming a produced, sub-truncate portion. Tenth tergite long, set off from ninth by a declivity, humped at apex and bearing a pair of long, deep, flat, apical processes which converge at apex and whose mesal side is concave. Claspers with basal segment three times length of apical one, slightly sinuate and enlarged for the apical half; apical segment nearly parallel sided, apex rounded. Aedeagus, figure 73, angled twice, sharply; basal portion very long and wide; apical portion with paired ovoid, dorsal sclerites and extreme apex cup-shaped, bearing a pair of pockets of retractile spines. Behind the dorsal sclerites arise a pair of furcate, membranous appendages, each with a wing-like lateral projection and a tail-like basal projection, both studded with spinules.

Female. Similar to male in size, color, and general structure. Genitalia typical for genus; diagnostic characters have not yet been discovered to separate the females of this group of species.

Holotype.—Male; Costello Lake, Algonquin Park, Ontario Fisheries Research Laboratory; June 10, 1939; (W. M. Sprules; Cage #2).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—4♂; same data as for holotype.

Paratypes are in the collections of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Hydropsyche recurvata Banks

ONTARIO: Kenora; June 16, 1908, 5 ♂, [ANSP].

Potomyia flava (Hagen)

ARKANSAS: Dardanelle, Pope Co.: Aug. 14, 1939, 200 feet alt., (Rehn & Rehn), 1 ♂, [ANSP].

Macronema zebratum Hagen

NEW JERSEY: Delaware Water Gap; July 15, 1 ♂: July 9, 1 ♀; [ANSP].

PENNSYLVANIA: Mt. Pocono, Monroe Co.; June 9–19, 1906, (A. S. Calvert), 2 ♂, [ANSP]. Philadelphia; June 4, 1 ♂, [ANSP]. Clarks Ferry; July 4, 1915, (F. Haimbach), 2 ♂, 1 ♀, [ANSP]. Cone Mt.; July 4, 1915, 1 ♀, [ANSP].

Macronema carolina Banks

NEW JERSEY: Franklinville; July 12, 1936, light, 1 ♂, [ANSP].

Family MOLANNIDAE

Molanna uniophila Vorhies

MAINE: Greenville; July 21–29, 1919, (F. Haimbach), 8 ♂, [ANSP].

Family LEPTOCERIDAE

Athropsodes miscus new species (Pl. X, fig. 75.)

The general type of the genitalia shows this species to be most closely related to *annulicornis*. It may be differentiated from it on the basis of the U-shaped aedeagus and in the upturned and stouter tenth tergite.

Male. Length 9 mm. Color brown, the antennae, legs, and abdomen a lighter shade than the remainder; wings uniformly medium brown. Structure typical for genus. Eyes very small, only little larger than the basal segment of the antennae.

Genitalia as in figure 75. Ninth segment annular and narrow. Cerci small, short, and with their apices making a rather wide angle. Tenth tergite wide at base, short and upturned, the upturned edges thickened at the apex with an angulate dorsal margin. Claspers with apical segment short, lozenge-shaped and semimembranous, with a mesal peripheral row of setae; digitate lobe approximately half length of apical segment, slightly conical in shape; basal segment almost three times as long as apical segment, produced caudo-ventrad into a long, sharp point, with a flat, flap-like, triangular, small, mesal lobe at apex and with a scattering of long setae along most of its length. Aedeagus U-shaped, the base sclerotized and cylindrical, the portion beyond the U consisting chiefly of membranous folds; within these can be distinguished a single, weak, curved spine.

Holotype.—Male; near Trout Lake, Wisconsin; July 21–23, 1937; (H. H. Ross), [INHS].

Paratype.—1 ♂; Itasca Park, Minnesota; June 20, 1938; (H. E. Milliron).

Paratype deposited in the collection of the University of Minnesota.

Athripsodes wetzeli new species (Pl. IX, fig. 74.)

Although similar in many respects to the preceding, this species may be distinguished from it on the basis of the narrow apex, lateral spur, and definite baso-dorsal corner of the tenth tergite.

Male. Length 7.5 mm. Color and general structure almost identical with the preceding species. Diagnostic characters apparently confined to the genitalia, as in figure 74. Ninth segment annular and narrow, cerci short, with lateral margins sinuate and their apices fairly broadly angled. Tenth tergite with its dorsal length very short due to the sharp rise and conspicuous dorsal angle of the base; seen from above it is wide at base and tapers rapidly to a sharp apex; near the baso-ventral corner arises a spur which is sclerotized but small and closely appressed to the tergite. Claspers with apical segment about one-half length of first, membranous and lozenge-shaped; digitate lobe very short and somewhat ovate; basal segment long and narrow, the base produced into a curved point, the apex produced into a triangular, flap-like, mesal lobe and the caudal margin armed with a series of very long setae. Aedeagus short, consisting of a round, semimembranous base which tapers to a blunt, narrowed apex; within base near the dorsum are a pair of stout spines which lie side by side when seen from lateral view.

Female. Similar in length and general structure to male, differing in being more robust and the different form of the genitalia. Apex of abdomen as in related species.

Holotype.—Male; Kettle Creek, Clinton County, Pennsylvania; June 30, 1938; (C. M. Wetzel).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—1 ♂; Costello Lake, Ontario Fisheries Research Laboratory, Algonquin National Park, Ontario; June 23, 1938, (W. M. Sprules; station #4): 1 ♂; cage #4, June 29, 1939. 5 ♂, 41 ♀, same data as for holotype. 1 ♂; along Wisconsin River, Merrill, Wisconsin; June 18, 1934, (Frison & Mohr).

Paratypes are in the collections of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Athripsodes alces new species (Pl. X, fig. 76.)

This species is most closely related to *resurgens* (Walker), but differs in the expanded apex of the tenth tergite, narrower claspers and other differences of the genitalia.

Male. Length 10 mm. Color medium to dark shades of brown, the antennae, abdomen, and wings a lighter shade than the remainder. General structure typical for genus, including structure of legs, mouth-parts, and wings. Eyes very small, separated on the dorsum by about five times the dorsal width of one eye.

Genitalia as in figure 76. Ninth segment shoe-shaped, its basal margin straight, its apical margin produced into a wide area with which the claspers articulate. Cerci separated from ninth only indistinctly, tapering to a fairly narrow apex and clothed with a scattering of fine setae which are more crowded at apex. Tenth tergite divided into a pair of lateral, vertical plates separated by a small, clavate piece; these lateral plates are constricted near the middle to form a narrow neck beyond which there is a markedly expanded head studded with fairly stout, curved setae and below which there is a moderately wide, sclerotized plate heavily scored by a curved, declivous concavity. Claspers with apical segment bent at right angles to base, the mesal, sclerotized lobe projecting from below to above the apical segment; basal segment long and with the base produced into a foot-like point bearing several stout setae; the entire caudal surface of the basal segment bears a covering of long and short setae. Aedeagus with a cup-shaped, semimembranous, sclerotized base and an irregular, somewhat cylindrical, apical portion composed chiefly of membranous folds; within which is contained a large, curved spine running down the center, and near the dorsal margin is a less distinct sclerotization which seems to be a supporting rod of the outer margin.

Holotype.—Male; along Chippewa River at Moose Lake, Hayward, Wisconsin; August 16, 1938; (T. H. and T. H. Frison, Jr.).

Paratypes.—1 ♂; Costello Lake, Algonquin Park, Ontario Fisheries Research Laboratory, Ontario; July 6, 1938; (W. M. Sprules; cage #4). 4 ♂; same data as for holotype.

Paratypes are in the collections of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Athripsodes resurgens (Walker)

MAINE: Greenville; July 21–29, 1919, (F. Haimbach), 2 ♂, [ANSP].

Athripsodes cancellatus (Betten)

PENNSYLVANIA: Philadelphia; June 30, 1911, 1 ♂, [ANSP]; around electric lights, Eighth and Chestnut, (S. F. Aaron), 1 ♂, [ANSP].

Athripsodes tarsipunctatus (Vorhies)

PENNSYLVANIA: Philadelphia; June 27, 1899, 1 ♂, [ANSP].

Athripsodes flavus (Banks)

PENNSYLVANIA: (S. F. Aaron), 2♂. Philadelphia, Eighth and Chestnut; around electric lights, 9:00 p.m., (S. F. Aaron), 1♂, [ANSP].

Leptocella exquisita (Walker)

MAINE: Greenville; July 21–29, 1919, (F. Haimbach), 1♂, [ANSP].
PENNSYLVANIA: Fites Eddy, Lancaster Co.; 1♂, [ANSP].

Triaenodes nox new species (Pl. X, fig. 77.)

The very long cerci distinguish this species from all other nearctic members of the genus. It is most closely related to *aba* Milne, differing from it in the long, lateral lobes of the claspers and other points in the genitalia, in addition to the cerci.

Male. Length 8 mm. Color yellowish-brown, minute annulations on the antennae dark and the tibiae and tarsi paler.

General structure typical for genus. First segment of antennae subequal to dorsal length of head, and without a mesal pocket of pubescence.

Genitalia as in figure 77 and 77A. Ninth segment narrow above but produced into a scoop-like, long, ventral portion. Tenth tergite represented by a short, dorsal, semimembranous projection and by a wide, apron-like structure attached below the cerci. Cerci very long, filamentous for their entire length and clothed with a scattering of medium length setae. Claspers broad and somewhat bulbous at base. divided at apex into a mesal and lateral lobe; lateral lobe is pointed and finger-like; mesal lobe is lamellate and convex mesad, so that it appears broad on both lateral and ventral views; the entire clasper is clothed with a scattering of fairly long setae. From the base of each clasper arises the sclerotized, ribbon-like, recurved appendage typical of the genus; in this species these appendages are very narrow beyond the bend, progress alongside the aedeagus, becomes slightly but noticeably enlarged before apex and from this enlarged portion taper to a fine point. Aedeagus simple, divided at apex into an upper and lower lobe, the ventral lobe regular and spatulate, the upper lobe twisted to the right.

Holotype.—Male; Swansea, Ontario; August 12, 1937; (H. S. Parish).

Triaenodes florida new species (Pl. X, fig. 78.)

This species can be distinguished from any described North American species by the double mesal lobe of the claspers and the short, filiform, basal appendage which in all other species forms a long, recurved, filiform structure. This species is probably most closely related to *taenia* Ross from which it can be separated by the characters given.

Male. Length 9.5 mm. Color light brown, except for the dark annulations at each antennal joint and the black tufts of hair on the maxillary palpi and legs; the wings have a longitudinal area down the center which is lighter than the rest. General structure typical for genus; basal segment of antennae only slightly enlarged and a little longer than greatest length of eye, without a mesal pouch of setae.

Genitalia as in figure 78. Ninth segment annular, produced into a short, shelf-like, ventral portion with which articulate the claspers and aedeagus. Tenth tergite composed of a hump-like, basal portion which narrows suddenly to a pair of style-like processes forming a "V," each tipped by a long, slender bristle; beneath this is a mesal membranous lobe and at the lateral edge of the segment another short, spine-like process bearing a long spine at apex. Cerci short and narrow, clothed with abundant setae of moderate length. Claspers with a broad base, the remainder of it readily divided into four areas: (1) a curved, pointed, lateral process covered with rather dense, long setae, (2) an apico-mesal lobe which is quite convoluted and concave on its mesal area, its mesal surface studded with moderately long but quite stout setae, (3) a baso-mesal lobe which is robust and bears a scattering of long setae, and (4) a finger-like process which arises from a basal projection of the clasper, the process itself curving only slightly and completely devoid of pubescence. Aedeagus connected with the ninth sternite by a pair of broad bands; seen from lateral view, it is arcuate, broadest at base and apex; the dorsal surface is wide and flange-like and evenly excavated down the meson to form a deep groove.

Holotype.—Male; Gainesville, Alachua County, Florida; April 2, 1939, (L. Berner).

Paratype.—1 ♂; same data as for holotype. 3 ♂; Ebro, Washington Co., Florida; May 30, 1940, (L. Berner).

Paratypes are in the collections of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Triaenodes flavescens Banks

PENNSYLVANIA: (S. F. Aaron), 1 ♂, [ANSP].

Triaenodes tarda Milne

NEW YORK: Niagara Falls; July 12, 1908, 1 ♂, [ANSP].

Mystacides sepulchralis (Walker)

MAINE: Greenville; July 21–29, 1919, (F. Haimbach), 1 ♀, [ANSP].

NEW YORK: Bolton, Bolton Co.; Aug. 19–23, 1929, (E. T. Cresson, Jr.), 26 ♂, 2 ♀, [ANSP].

PENNSYLVANIA: Wyalusing, Bradford Co.; Aug. 3–4, (W. G. Deitz), 2 ♂, 1 ♀, [ANSP].

VIRGINIA: Mt. Lake; Aug. 3, 1915, (P. P. Calvert), 3 ♂, [ANSP].

Mystacides alafimbriata Hill-Griff

W[ASHINGTON] T[ERRITORY]: 19 ♂, 1 ♀, [ANSP].

Oecetis inconspicua (Walker)

ALABAMA: Shoal Creek, near Killen, Lauderdale Co.; Aug. 8, 1939, 500 ft. alt., (Rehn & Rehn), 1 ♂, [ANSP].

ARKANSAS: Five miles north of Jasper, Newton Co.; Aug. 11, 1939, 1000 ft. alt., (Rehn & Rehn), 1 ♂, [ANSP].

FLORIDA: Daytona; March, 1907, (P. Laurent), 1 ♂; no data, 1 ♂, 2 ♀; [ANSP].

MAINE: Greenville; July 21–29, 1919, (F. Haimbach), 4 ♂, [ANSP].

NEW JERSEY: Gloucester Co.; June 10, 1906, (F. Haimbach), 1 ♀, [ANSP].

PENNSYLVANIA: 1 ♂. (S. F. Aaron), 1 ♂, 2 ♀. Roxboro; July 17, 3 ♂: June 7, 1 ♂. Philadelphia; Aug. 23, 1901, 1 ♂: Aug. 8, 1901, 1 ♀: July 11, 1940, 1 ♀: July 14, 1899, at window, 1 ♀. [All ANSP].

TEXAS: 1 ♂, 1 ♀, [ANSP].

W[ASHINGTON] T[ERRITORY]: 1 ♂, [ANSP].

Oecetis cinerascens (Hagen)

ALABAMA: Shoal Creek, near Killen, Lauderdale Co.; Aug. 8, 1939, 500 ft. alt., (Rehn & Rehn), 1 ♂, [ANSP].

Oecetis georgia new species (Pl. X, figs. 79 & 79A.)

This species is most closely related to *persimilis* Banks but may be differentiated from it by the asymmetrical, ventral aspect of the claspers and characters of the aedeagus.

Male. Length 8 mm. Entire body and appendages light brown with darker shades of brown on the dorsum, base of legs, and upper parts of pleurae. General structure typical for genus; cross veins of front wing forming a step-like series instead of a cord.

Genitalia as in figure 79. Ninth segment cylindrical, the dorsal portion reduced to a narrow bridge and the dorso-lateral portion produced into a strong, sharp spine. Tenth tergite finger-like and bearing a semimembranous flap directly beneath it. Cerci somewhat ovate, clothed with a scattering of medium to long setae. Claspers long, basal portion forming a very irregular and somewhat rectangular area which tapers suddenly to the narrow, apical part; from ventral view the left one tapers regularly from base to apex, but the right one expands from the base and then contracts suddenly to form a well-marked, basal lobe; both claspers are clothed with a scattering of medium to long setae. Aedeagus large, the base bulbous, the apex with a sclerotized, ventral beak, a shoe-like, dark, sclerotized, lateral appendage and the remainder consisting of irregular, membranous folds.

Holotype.—Male; five miles south of Roberta, Georgia; May 12, 1939; (P. W. Fattig).

Paratype.—1 ♂; same data as for holotype, but May 9; [INHS].

Oecetis sphyra new species (Pl. X, figs. 79B & C.)

This species is a close relative of *scala* Milne. It differs from it in the longer lobes of the tenth tergite which bear only a single, apical, spike-like seta instead of two (one apical and one preapical) in *scala*. Differences occur also in the asymmetrical, apical parts of the aedeagus: the right hand sclerotized lobe in *scala* is narrowed at base and produced into a dorsal point at apex, and the sclerite held at approximately the same angle and level as the left sclerite; in *sphyra* the right sclerite is shoe-shaped, constricted at base, bears no apico-dorsal point and is held considerably lower than the apex of the left sclerite.

Male. Length 7 mm. Color of entire body light brown with the exception of darker shades of brown on the dorsum, upper parts of pleurae, basal sclerites of legs, small patches in forks of a few principal veins in front wings. General structure typical for genus; cross veins of the front wing forming a step-like series rather than a cord.

Genitalia as in figure 79B & C. Ninth segment somewhat oblique with a caudal projection near venter to receive the claspers and another caudal projection extending somewhat below and under the lobes of the tenth tergite; this latter projection is somewhat foot-shaped. Tenth tergite composed of a pair of round, heavily sclerotized, long, angled rods which are very slender, expanded slightly at apex and bear at the apex a spike-like seta; these two processes lie parallel to each other and hang down between the claspers. Cerci slender, long, and round, bearing a scattering of short and long setae. Claspers with many irregularities along the margins but composed essentially of a large, quadrate, basal portion which narrows abruptly to an equally long, finger-like apical portion; lateral surface is clothed with a scattering of medium length setae and the dorsal margin bears a scattered line of slightly stouter but shorter setae. Aedeagus with a narrow, sclerotized, and tubular base which is divided at the apex into a ventral pair of sclerotized lobes and a mass of dorsal, membranous folds; the two apicoventral lobes are quite dissimilar in shape—the left one is sickle-shaped, the right one is shoe-shaped, rounded at the apex, constricted at the base and pointing much more ventrad than the left one.

Holotype.—Male; Thomaston, Georgia; June 8, 1939; (P. W. Fattig).

Paratype.—1 ♂; same data as for holotype, [INHS].

Leptocerus stehri new species (Pl. X, fig. 80.)

The short, deep lobes of the tenth tergite and the stocky cerci separate this species from *vernalis* Banks, its closest relative.

Male. Length 8 mm. Color straw color to white except for black eyes and the slightly yellowish membrane of the wings. General structure typical for genus. Antennal segment short but enlarged and semiglobose, eyes large, their greatest width, seen from above, equal to one-half of the width of the head at this point. Body and appendages slender. Genitalia as in fig. 80. Ninth segment wide and annular, narrowed dorsad to form a bridge which merges with the tenth tergite. Tenth tergite with a broad base which fuses with the ninth segment at the base and the cerci at the sides, the combined assemblage giving the appearance of a four-pronged structure; the cerci are covered with closely appressed, flattened hair; the apex of the tenth tergite is divided down the meson into a pair of long, deep plates rounded at apex. Claspers very long, angled at extreme base, the dorsal and ventral margins irregular, producing a slight enlargement beyond angle, a gradual constriction to near apex and apex slightly enlarged and tapering to a pointed tip; aedeagus with main body angled near middle, robust and with a rounded, beak-like point; from the base arises a pair of long, sclerotized, slender rods.

Female. Length, color, and general structure as for male. Genitalia as in figure 80. Ninth segment large and sclerotized, fitting into an apical, sclerotized, invaginated ring borne at the apex of the membranous eighth segment. Ventral region of ninth undulating with a high, raised, mesal area, and a declivous and sinuate latero-dorsal margin. Dorsal margin is sharply notched to receive the tenth tergite and below and beyond this notch is a spatulate lobe armed with setae at apex. Ventro-apical margin wide and sinuate at corners; projecting from above it is a subtriangular lobe bearing abundant setae and above which lie a pair of concave, flat sclerites fused to its dorso-lateral margin. Attached to these sclerites is an elaborate internal arrangement of sclerotized plates and lobes as shown in fig. 80B. Tenth tergite small, its apical margin with a round emargination at the apex of which is a raised mesal carina.

Holotype.—Male; Cherokee, North Carolina; June 28, 1938; (W. C. Stehr).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—2 ♂; Lakemont, Georgia; June 30, 1939, (P. W. Fattig). 4 ♂, 6 ♀; same data as for holotype.

Paratypes are in the collections of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Leptocerus americanus (Banks)

PENNSYLVANIA: Philadelphia; June, 1925, 1 ♂, [ANSP].

Family ODONTOCERIDAE

Marilia flexuosa Muller

MEXICO: Texola, Vera Cruz; March 2, 1897, 1 ♂, [ANSP].

Family PHRYGANEIDAE

Agrypnia pagetana Curtis

W[ASHINGTON] T[ERRITORY]: 3♂, [ANSP].

Dasystegia vestita (Walker)

PENNSYLVANIA: Fairmount, Philadelphia; June 5, 1904, (F. Haimbach), 1♀, [ANSP].

Phryganea cinerea Walker

MAINE: Greenville; July 21–29, 1919, (F. Haimbach), 2♂, 5♀, [ANSP].

NEW YORK: Bolton, Bolton Co.; Aug. 19–23, 1929, (E. T. Cresson, Jr.), 1♀, [ANSP].

Family LIMNEPHILIDAE

Radema sorex new species (Pl. XI, fig. 82.)

This species is most closely related to *aenicta* (Ross), but differs from it in the short, pear-shaped, apical segment of the claspers.

Male. Length 9 mm. Color very dark brown with the following exceptions: mouthparts (except palpi), portions of hind femora and tibiae, and exposed membrane, which are cream color. General structure typical for genus including size and position of cephalic and thoracic warts, setation and wing venation. Spur count of legs 1–2–4.

Male genitalia as in figure 82. Ninth segment annular, reduced on the dorsum to a narrow collar. Tenth tergite consisting of a complex of at least three paired parts: (1) a dorsal, finger-like, closely appressed pair armed with more or less regularly placed setae pointing laterad, (2) a lateral pair of slender, sclerotized processes, each divided into a long, slightly clavate, dorsal arm and a short, finger-like, ventral arm, each with a small cluster of setae at apex, and (3) a ventral pair of heavy, sclerotized appendages which together make a shelf beneath the others. Cerci short and stocky, covered with a scattering of rather fine setae and very intimately connected with the tenth tergite. Claspers with a broad, cylindrical, basal segment, bearing medium length setae at base and very long, heavy setae towards apex; apical segment pear-shaped, robust, covered with a dense vestiture of fine setae and surmounted at the apex by a sclerotized, spike-like process. Aedeagus with basal portion vasiform, and with apical portion containing a central, sclerotized rod which is surrounded by a sclerotized, cup-like structure on either side of which is a short, sclerotized rod; both this rod and the cup merge at their base with the membranous folds of the aedeagus so that only the apex appears distinct.

Holotype.—Male; Multnomah Falls, Multnomah County, Oregon; April 8, 1939; (S. G. Jewett, Jr.).

The genus *Radema* Hagen is apparently the name which should be applied to this group. Forsslund (1929) has demonstrated that

Apatania Kolenati should be a synonym of *Molanna.* This leaves three names in the complex—*Radema* Hagen, *Apatidea* McLachlan, and *Apatelia* Wallengren. In the past, these have been separated on the basis of tibial spur count, but the cord-like formation of cross veins in the front wings and the two-segmented claspers, together with the curious "stigmatic" cell indicate that this is best treated as a single genus. Of the available names, *Radema* is the oldest.

LEPANIA new genus

This genus belongs to that group of genera which bridge many of the gaps between the Limnephilidae and Sericostomatidae, to wit: *Allomyia, Radema* and their allies. It is separated from them, however, by the oblique cord formed by the cross-veins of the front wing between R_2 and Cu_1; and by the shoe-shaped hind wing with its very small anal area (Fig. 81).

Characteristics.—General structure typical for family. Head wide; eyes small, malar space wide; ocelli present; median pair of warts small and approximate, caudo-lateral pair fairly large, oblique and well separated across meson. Wings (Fig. 81), of about equal size. Front pair rounded at apex, with venation simple and with cross-veins forming an oblique cord from R_2 to Cu_1. Hind wings shoe-shaped; R_1 atrophies after its separation from Rs; cross-veins form a cord somewhat similar to that in the front wings; anal region very small and unexpanded. Legs long, hairy, tibial spur count 1–2–3, all spurs short.

GENOTYPE. *Lepania cascada* new species.

Lepania cascada new species (Pl. XI, fig. 81.)

Diagnostic characters for separating this species from related forms are given in the generic description above.

Male. Length 6.5 mm. Color black, under high magnifications appearing very dark brown; legs slightly lighter, especially the tibiae and tarsi, and clothed with almost tawny hair; general structure as given for genus.

Genitalia as in figure 81A. Ninth segment widest along sides, narrowed both ventrad and dorsad. Tenth tergite heavily sclerotized and upturned, incised at the apex to form a pair of widely separated, heavily sclerotized, arms separated by a submembranous area. From the base of the tenth tergite arises a slender membranous tentacle bearing a few setae at apex. Cerci wide, projecting farther than the tenth tergite, slightly twisted in contour and with an irregular sinuate depression on the dorso-mesal margin. Claspers two-segmented, the basal segment short and stocky, the apical segment long, heavily sclerotized, round and curved, the surface smooth with two or three setae near apex. Aedeagus short, not freely extensile, with a short, vasiform base and two pairs of heavily sclerotized rods arising from the face; the ventral pair is sinuate and points laterad at apex, the dorsal pair is slightly less sinuate but points mesad at apex; between the bases of these are membranous folds and within these a sclerotized, rod-like structure which probably supports the penis.

Female. Length, size, color, and general structure typical for male. Genitalia as in figure 81C. Eighth tergite simple, the apical margin bearing a row of small and irregular warts, each with from one to four setae. Eighth sternite divided for its entire length, forming a pair of fairly free flaps. Ninth tergite divided by a V-shaped incision nearly to base. Ninth sternite divided into a semisclerotized lateral plate and two membranous mesal plates, a ventral one which has the apical margin incised to form three finger-like lobes and a dorsal one which is arcuate; between these two the bursa copulatrix apparently opens. Tenth tergite represented by a round plate closely appressed to the hood-like ninth tergite. Bursa copulatrix short, pouch-like with a small, egg-shaped, central cavity and with two sinuate, sclerotized, lateral flanges as in figure 81B.

Holotype.—Male; Boyer, Lincoln County, Oregon; elevation 1400 ft. from trail; April 27, 1935, (M. L. H.).

Allotype.—Female; same data as for holotype; [INHS].

Paratype.—1 ♀; Tide Water, Oregon; April 21, 1935; (J. Schuh); [INHS].

Dicosmoecus atripes (Hagen)

COLORADO: Manitou; July 18, (H. Skinner), 1 ♂, [ANSP].

CALIFORNIA: Inyo Co.; Oct. 1, 1922, (Poline), 2 ♂. "Cala."; 3 ♂, 2 ♀; [all ANSP].

IDAHO: mouth, Upper Salmon River, Smiley Creek; 7200 ft. alt., August 16, 1928, (Rehn & Hebard), 5 ♂, [ANSP].

NEW MEXICO: Beulah, (H. Skinner), 1 ♂, [ANSP].

OREGON: Strawberry Creek, Strawberry Mts.; 4500 ft. alt., Aug. 20, 1928, (Rehn & Hebard), 1 ♂, [ANSP].

Dicosmoecus unicolor (Banks)

CALIFORNIA: Inyo Canyon; Oct. 1, 1922, (Poline), 2 ♀, [ANSP].

IDAHO: mouth, Upper Salmon River, Smiley Creek; 7200 ft. alt., July 16, 1928, (Rehn & Hebard), 1 ♂, [ANSP].

OREGON: Strawberry Creek, Strawberry Mts.; 4450 ft. alt., Aug. 20, 1928, (Rehn & Hebard), 2 ♂, [ANSP].

Oligophlebodes ardis new species (Pl. XI, fig: 83.)

This species differs from *minutus* Banks, which it resembles most closely, in the dark color of the thorax and legs in both sexes, in the structure of the three sclerotized rods of the aedeagus in the male, the small lateral and large mesal lobes of the ninth sternite in the female, and in the more concave pronotum of the larvae.

Male. Length 8.5 mm. Color of head, thorax, and abdomen dark brown; antennae with basal segment yellow, remainder medium brown; legs various shades of brown with the hind tibiae yellowish; wings tawny with a few slightly darker markings near middle. General structure typical for genus. Dorsum of head almost three times as wide as long. Legs with typical spur count of 1–2–3. Eighth segment simple, with an irregular row of apical setae.

Male genitalia as in figure 83. Ninth segment annular, the dorsal portion composed chiefly of membranous folds. Tenth tergite and other parts very conspicuous. Tenth tergite membranous, bearing at the lateral margin a semimembranous lobe armed with long setae; this lobe may be the cercus. Below this is a foot-like lobe of the lateral margin, bearing a few scattered setae. The ninth sternite is deeply excavated on the ventral half of the lateral margin, and the ventral margin is produced into a triangular and slightly upturned apex. Claspers with base globose, apex forming a short beak; from dorsal view the mesal margin is slightly serrate at tip; the entire structure bears a few scattered setae. Aedeagus composed of a semimembranous, stout, vase-like shell within which are a group of three sclerotized rods, the central rods straight, lateral pair sinuate.

Female. Size, color, and general structure typical for male. Eighth tergite simple, with only a few scattered setae at apex. Eighth sternite fused with subgenital plate by a smooth, semisclerotized area; the sternite below this bears a few scattered setae and some fine hair. Ninth and tenth tergites fused, together forming a pair of conical lobes which are subdivided at tip into a larger apical lobe and a smaller lateral lobe. Subgenital plate membranous. Subgenital plate with a pair of subtriangular lateral lobes, bearing dense setae on the apico-lateral corner, which fuses with the mesal truncate lobe. This latter extends beyond this point of fusion some distance and projects as an exposed plate. Basad of these three processes are some irregular sclerotized areas and a pair of lateral patches of long setae. Internal structures connected with the subgenital plate and forming the sclerotized part of the bursa copulatrix including a sclerotized, ventral, pointed lobe and above it a flat plate with a rounded margin and a mesal opening; these two structures are capable of movement independently of the sclerites to which they are attached and are seldom seen in a perfectly symmetrical position.

Holotype.—Male; along a swift creek, elevation 10,000 feet; Berthoud Pass, Colorado; July 24, 1938, (H. H. & J. A. Ross).

Allotype.—Female; same data as for holotype; [INHS].

Paratype.—1 ♂; same data as for holotype; [INHS].

Oligophlebodes minutus (Banks)

New Mexico: Beulah; June 29, 1902, 1 ♂, [ANSP].

Frenesia difficile (Walker)

PENNSYLVANIA: Roxborough; Nov. 22, 1913, 1♂, 1♀, [ANSP].

Frenesia praeteritum (Walker)

ALASKA: Admiralty Bay; June 26, 13♂, [ANSP].

Limnephilus ectus new species (Pl. XI, fig. 84.)

This species resembles most closely *extractus* Walker, and may be separated from it by the sclerotized, bushy, lateral arms of the aedeagus.

Male. Length 15.5 mm. Color tawny, except for the spines on the hind legs which are black and a row of dark markings along the anal third of the front wing. General structure typical for genus, the head with macrochaetae situated just in front of and postero-mesad of each median wart. Macrochaetae of head, pronotum, and mesonotum tawny and not contrasting with the surface of the sclerite; front legs with tibial spur sharp and yellowed; basitarsus long, almost equal to the length of the two following. Wings long and with the apical margin slightly incised. Eighth tergite with apex produced into a rounded mesal lobe covered with a thin batch of stout, minute, brown setae.

Genitalia as in figure 84. Ninth segment of only medium length, with a step-like angle of the posterior margin forming a shelf for the cerci and reducing the dorsal part of the segment to a narrow strap. Tenth tergite forming a pair of plates with a flat, irregular base from which arises the thin apical plate; this is heavily sclerotized, clothed with a scattering of thin setae and about two-thirds as long as the cerci. Cerci tapering regularly from base to near apex, the apico-ventral angle incurved and armed with three stout sclerotized teeth; the lateral face is clothed with scattered setae, the dorsal angle with an irregular row of longer setae and the mesal face is crossed near apex by an arcuate ridge bearing sclerotized elevations. Claspers short and wide, clothed with abundant long and short setae and bluntly pointed at apex. Aedeagus with mesal tube tapering from base to apex, surmounted by a mass of membranous folds bearing a few small, sclerotized plates; lateral arms about as long as mesal tube, quite stout, enlarged beyond base and upturned at apex, the upturned part clothed with flattened setae in a more or less irregular face, the dorsal part below this covered with a close brush of long flattened setae.

Holotype.—Male; Boyer, Oregon; July 15, 1934; (M. L. H.).

Limnephilus labus new species (Pl. XI, fig. 85.)

This species occupies an interesting position in regard to some of the characters which have been used as fundamental divisions of *Limnephilus.* It is closely related to *perpusillus* Walker in which the front basitarsus is subequal to the following segment; yet in *labus* the front basitarsus is only one-half the length of the following segment. These two are more closely related to each other than to any other species; yet if the secondary sexual characters of the male front tibiae were used as generic criteria, these two would be placed in separate genera. Of the species with short, front basitarsi, the species most closely resembles *spinatus* but differs from it in the flattened brush-like lateral lobes of the aedeagus (these are seta-like in *spinatus*).

Male. Length 11.5 mm. Color brown with a slight orange cast. General structure almost identical with the preceding except for the following differences: area behind anterior ocellus with only three pairs of macrochaetae; front tibiae with none to two black spines, the apical spur black and slightly fusiform; front basitarsus one-half length of succeeding segment.

Eighth tergite with a small, apico-mesal lobe covered with a pad of black spinules.

Genitalia as in figure 85. Ninth segment fairly wide across the central portion, reduced dorsally to a very narrow bridge and with the shelf for the cerci declivous. Lobes of tenth tergite with a wide foot and with the mesal blade small but produced into a sharp, up-turned apex. Cerci somewhat triangular, the posterior margin sinuate and the mesal area of the apico-dorsal region produced into a sharp, long, heavily sclerotized spine; the entire lateral and dorsal area is covered with short to moderate length setae with longer setae towards apex. Claspers longer than wide, the size subparallel, the dorsal corner small and sharp, the ventral corner rounded, the entire clasper clothed with fine setae with a few longer ones near base. Aedeagus relatively short, the central style cylindrical, moderately robust and with the lateral plates of the head notched at base; lateral arms shorter than central body, enlarged and up-turned into an apical, sinuate lobe bearing a comb of fine setae along the posterior margin and with the apex crowned with a few short, pointed spurs and one or two long ones at extreme apex.

Holotype.—Male; from Wood Lake near University of Colorado Science Lodge, Boulder, Colorado; July 26, 1939; (U. Lanham).

Allotype.—Female; Tolland, Colorado; (G. S. Dodds; #237); [INHS].

Paratypes.—1 ♂; Lethbridge, Alberta; August 27, 1913; (E. H. Strickland). 8 ♂, 9 ♀; same data as for allotype.

Paratypes are in the collections of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

This species was reared at the type locality from a dark-headed larva building a regular, tightly constructed, sand-grain case.

Limnephilus perpusillus Walker

1935. *Colpotaulius rhaeus* Milne, Studies in N. A. Trichoptera, II, p. 42. (♂, ♀). [New synonymy.]

1938. *Limnephilus merinthus* Ross, Ill. Nat. Hist. Surv. Bull., XXI, p. 166, (♂, ♀). (March.) [New synonymy.]

The fine elucidation of Walker's type by Betten and Mosely finally clears up the status of this species. Since describing *merinthus,* Dr. Milne kindly extended me the opportunity to study his types, and it is clear that not only are *merinthus* and *rhaeus* the same, but also are identical with *perpusillus.*

Limnephilus lunonus new species (Pl. XI, fig. 86.)

This species is most closely related to *perpusillus* Walker, but differs in its larger sized, yellow, apical spur of front tibiae, and the absence of a sclerotized mesal point on the apico-dorsal corner of the cerci. In general size and color, this species approaches *productus* but differs radically from it in genitalia, especially the high, pointed, and recurved lobes of the tenth tergite.

Male. Length 16 mm. Color almost entirely light brown of an orange shade, with the eyes, legs bristles, and irregular flecks on the wings dark brown or black. General structure typical for genus. Head with a pair of macrochaetae situated mesad of and slightly posterior to lateral ocelli; posterior warts with four to five macrochaetae; two macrochaetae situated in front of each lateral ocellus and another group situated in the triangle just behind anterior ocellus. Pronotum consisting chiefly of two cushion-like warts with abundant macrochaetae. Mesoscutellum with a linear wart reaching almost to scutellum and bearing about five macrochaetae and several small ones. Wings long with long setae along the principal veins especially in the anal and cubital regions. Front femora large, their under side covered with a linear patch of black spinules; front tibiae with four black spines on their outer surface, the underside with a linear patch of black spinules, the apical spur long, pointed and yellow; front basitarsus equal in length to the second. Eighth tergite with a small apical projection covered with black spinules.

Genitalia as in figure 86. Ninth segment reduced dorsally to a narrow bridge and with the portion joining the cerci almost vertical. Lobes of tenth tergite with a long, slender foot and the mesal blade small, pointed, and recurved; the impression of slenderness is augmented by the transparency of the membranous posterior portion. Cerci tapering and recurved towards apex, held in an almost horizontal position, clothed with abundant, scattered setae which are very long towards apex and bearing on its mesal margin a slightly sclerotized elevation which terminates some distance before the apex. Clasper broad and short, with rounded apex and clothed with abundant setae of moderate length in addition to four or five very long, black setae arising near its base.

Aedeagus as in figure 86A; central style slender and head small, its lateral plates hook-shaped; lateral arms longer than central portion, the apex forming a sinuate lobe whose apical margin bears a comb of light and relatively fine setae and whose apex bears a crown of heavily sclerotized, long spines.

Holotype.—Male; Halfmoon Bay, California; September 24, 1936; (W. H. Leng).

Paratypes.—1 ♂; Stayton, Oregon; May 8, 1936; (J. Schuh); [INHS].

Limnephilus arizona new species (Pl. XII, fig. 87.)

The dorsal view of the genitalia, showing the stocky lobes of the tenth tergite and the truncate claspers, differentiates the male of this species from its nearest ally, *L. abbreviatus* Banks. In the female, the apex of the tenth tergite is much narrower than in either *despectus* Walker or *abbreviatus* Banks.

Male. Length 11.5 mm. Color of head, thorax, and dorsum of abdomen various shades of dark brown; antennae, warts of pronotum, tibiae, and tarsi almost straw color, shading to yellow, spines on legs black; wings with membrane very pale with a salt and pepper scattering of brown markings and irrorations.

General structure typical for genus. Wart in front of lateral ocellus with one or two weak setae and one strong one which curves caudad over the ocellus. Mesad and slightly caudad over each median ocellus arises a single, strong bristle curving cephalad. Posterior warts of head, dorsal warts of pronotum and tegulae with abundant long, strong setae curving in various directions. Scutellar warts extending almost full length of scutum, bearing about five large and one or two small setae curving caudad. Anterior tibiae with about fifteen black spines distributed irregularly over the entire tibia and with a single, long, pointed, yellow spur. Front basi-tarsus slightly more than one and one-half times length of succeeding segment. Wings long and narrow, the angles pronounced and the apical margin almost truncate. Eighth tergite with the apico-mesal region humped and clothed with short, black spines, and with a thumb-like projection semidetached from the main sclerite at a much lower level than the apical hump, and also clothed with short, black setae. This structure is exactly the same in *abbreviatus*.

Genitalia as in figure 87. Ninth segment reduced to a strap dorsally, the lateral and ventral portions not greatly enlarged or widened. Claspers small and triangular, confluent ventrally with the ninth segment, clothed with abundant short setae and a group of five or six long, black setae. Cerci, as seen from lateral view, angled and wide, the lateral surface clothed with scattered short setae, the dorsal margin bearing several setae longer than the remainder. The mesal surface bears a heavily sclerotized, black, ventral ridge, raised into small, tooth-like points at the apex and near the base, the extent of which is best seen from the dorsal view. Tenth tergite, from lateral view, produced into a narrow projection not extending beyond cerci, and slightly up-turned at apex, the dorsal margin slightly concave. From dorsal view the clasper appears stocky, the lobes of the tenth tergite stocky and truncate with a dark, serrate lateral margin. Aedeagus as in *abbreviatus*, the lateral arms being membranous and extensile, surmounted by a cluster of spiculate setae.

Female. Length, color, and general structure as for male. Ninth sternite (Fig. 87B), produced into a pair of dorsal, dark, pointed plates which extend over the tenth tergite. Tenth tergite tubular, the apex narrowed to a fine point which is bifid as seen from above.

Holotype.—Male; Grand Teton National Park, Wyoming; July 14; (D. J. and J. N. Knull).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—2 ♂; Fredonia, Arizona; July 13, 1939; (Knowlton & Harmston). 3 ♂, 4 ♀; same data as for holotype.

Paratypes are deposited in the collections of the Illinois Natural History Survey, Ohio State University, and The Academy of Natural Sciences of Philadelphia.

Limnephilus submonilifer Walker

DELAWARE: 5 ♀, [ANSP].

NEW JERSEY: Westmont; May 7, 1936, (J Aebly), 1 ♀, [ANSP]. Cape May; (Witmer Stone), 3 ♂, [ANSP]. "New Jersey"; 1 ♂, [ANSP].

NEW YORK: Ithaca; June, 1936, (J. W. H. Rehn), 1 ♀, [ANSP].

PENNSYLVANIA: Delaware Co.; May 7, 1905, 1 ♂, [ANSP]. Philadelphia; May 19, 1909, F. Haimbach; at light, 1 ♀, [ANSP]: April 27, 1905, F. Haimbach; at light, 1 ♂, 1 ♀, [ANSP]: at light, Columbia Avenue, May 3, 1899, 1 ♀, [ANSP]: May 10, 1911, 1 ♀, [ANSP]. Roxborough; May 19, 1910, (F. Haimbach), 2 ♂, 2 ♀, [ANSP]: May 4, 1913, (F. Haimbach), 2 ♂, 4 ♀, [ANSP]: April 23, 1913, (F. Haimbach), 1 ♂, 1 ♀, [ANSP]: May 3, 1913, (F. Haimbach), 1 ♂, [ANSP]: May 9, 1909, (F. Haimbach), 2 ♂, [ANSP]. Swarthmore; May 3, 1937, (E. T. Cresson, Jr.), 1 ♀, [ANSP].

W[ASHINGTON] T[ERRITORY]: 5 ♀, [ANSP].

Limnephilus indivisus Walker

MASSACHUSETTS: Hyde Park; July 10, 1910, 1 ♂, [ANSP].

SASKATCHEWAN: Lloydminister; Aug. 31, (H. Skinner), 1 ♂, [ANSP].

Limnephilus cockerelli Banks

NEW MEXICO: Top of Las Vegas Range; July 28, 1902, (H. L. Viereck), 1 ♂, [ANSP].

Limnephilus pacificus Banks
W[ASHINGTON] T[ERRITORY]: 4♂, 18♀, [ANSP].

Limnephilus sericeus Say
W[ASHINGTON] T[ERRITORY]: 3♀, [ANSP].

Limnephilus bimaculatus Walker
MAINE: Greenville; July 21–29, 1919, (F. Haimbach), 2♂, 4♀, [ANSP].

Limnephilus praecox Hagen
LABRADOR: Bonne Experience: September 1, 1912, (H. C. Bryant), 1♂, [ANSP].

Limnephilus taronus new species (Pl. XII, fig. 88.)

The curious shape of the genitalia marks this species as very different from any other nearctic species. In many respects, they suggest a linking form between the *pulchellus* group and the *gravidus* group. The aedeagus is very similar to both these, but the species may be readily distinguished from both by the bifid, overhanging ninth tergite and the distinctive clasper.

Male. Length 13.5 mm. Head, antennae, and body very dark brown; legs brownish yellow; front wings chocolate brown with small, pale dots scattered over the entire surface and with two or three larger, irregular, pale areas along the central portion; hind wings hyaline. General structure typical for genus. Maxillary palpus short. Front legs with femora slender, tibiae armed with about eight black spines and one yellow apical spur, tarsi with first segment nearly twice length of second. Macrochaetae of head and thorax yellow. All major wing veins with scattered, long, slender setae.

Genitalia as in figure 88. Ninth segment cylindrical, narrow ventrad but wide dorsad. The apico-dorsal margin produced into a bifid roof-like structure extending beyond the cerci and tenth tergite. Tenth tergite composed of a pair of plates, each divided almost to base into an upper and a lower plate. Cerci somewhat U-shaped, flat, one end of the U mesad, the other laterad, the entire structure clothed with slender hair. Claspers enlarged at base, ribbon-like in central portion, with the apex long and finger-like and bent at a right angle to remainder. Aedeagus with central style large and membranous at base, tapering gradually to apex; lateral arms long and sclerotized, the apex forked as in the *pulchellus* group, with stout setae on both upper and lower branches of the fork.

Female. Length, color, and general structure as for male, body robust. Genitalia short (Fig. 88C), with ninth tergite short, fused with tenth and with a pair of short papillae before apex. Tenth tergite forming a flat tube with narrow, alar sides and with the dorsum forming a pair of short triangular projections. Supra-genital plate wide and arcuate. Subgenital plate set deeply into eighth sternite and composed of a narrow mesal lobe and two wider lateral areas. Eighth sternite with ventral portion flat.

Holotype.—Male; Point Barrow, Alaska; July 14, 1898; (E. A. McIlhenny); [The Academy of Natural Sciences of Philadelphia, no. 9114].

Allotype.—Female; same data as for holotype; [ANSP].

Paratype.—1 ♂; same data as for holotype; [INHS].

Asynarchus centralis Banks

W[ASHINGTON] T[ERRITORY]: 1 ♂, [ANSP].

Anisogamus costalis (Banks)

NEW MEXICO: Top of Las Vegas Range; (H. L. Viereck), June 28, 1902, 1 ♂, [ANSP].

PHILOCASCA new genus

This genus is apparently most closely related to *Anisogamus* but may be distinguished from it by the fused condition of Sc and R_1 in the hind wing.

Characteristics.—General structure typical for family. Head with malar space subequal to first segment of maxillary palpus; frontal triangle in front of antennae with two pairs of warts, posterior margin with a pair of medium sized warts separated on meson by a distance equal to two-thirds their length; no macrochaetae except on warts. Pronotum with mesal warts large and touching. Scutum and scutellum with warts round and small. Spur count of legs 1–3–4. Wings broad, rounded at apex; front wings with radio-medial cord (R_s to M_2) situated considerably beyond *m–cu;* anal cells short; hind wings with R_1 and Sc fused near apex, and with anal field greatly expanded.

GENOTYPE: *Philocasca demita* new species.

Philocasca demita new species (Pl. XII, fig. 89.)

Characters for differentiating this species from its allies have been given under the definition of the genus. The male genitalia are also different from related species.

Male. Length 14.5 mm. Color, yellowish-brown, except for the spines on the legs which are black. General structure as typical for genus.

Male genitalia as in figure 89. Ninth segment very short, reduced on the dorsal third to a thin strap with a short mesal projection. Tenth tergite and cerci fused; cerci constricted near middle, the apex forming a rounded plate; tenth tergite composed of a dorsal, unornamented lobe and a stocky ventral lobe whose apex is heavily sclerotized and rugose; the fusion takes place along the mesal face of the cerci. Claspers short and robust, the apico-mesal corner produced into a point. Aedeagus readily extensile, with a short basal cylinder to which articulate a dorsal pair of curved spines and an apical, clavate structure bearing the penis and composed of convolute membranous folds arranged in one mesal and two lateral groups, the central one with an inner sclerotized rod.

Holotype.—Male; Boyer, Oregon, Hood Craven Cabin; September 30, 1933; (J. A. A.).

Homophylax andax new species (Pl. XII, fig. 90.)

In general appearance, this species bears a close resemblance to *flavipennis* Banks, but differs from it in the structure of the genitalia, notably the smaller and heavier appendages arising between the claspers and the tenth tergite.

Male. Length 20 mm. Color yellowish-brown with the following exceptions: spines on legs black; anterior half of wing tawny; posterior half darker brown. General structure typical for genus. Dorsum of head without black macrochaetae, the area between lateral ocelli covered with an even scattering of yellow setae. Maxillary palpi with second segment slightly longer than third and about equal to second tarsal segment of front leg. Scutar warts lanceolate and bearing a group of yellow setae. Scutellum with a pair of converging rows of yellow setae which reach only two-thirds the distance to the posterior margin. Legs with a spur count of 1–3–4; all leg segments armed with black spines except for apical segment of tarsi; wing venation typical for genus, all of the cross veins forming a single, nearly straight, cord. Eighth tergite more heavily sclerotized than the remainder, the apico-dorsal portion depressed and with a high, sharp, median carina running the length of the depression and ending in an upturned point.

Genitalia as in figure 90. Ninth segment with a wide, ventral expanse, narrowed to a strap dorsally. Tenth tergite composed of a high, central carinate portion forming about two appressed lateral plates; each lateral plate forms a single, ventral, heavily sclerotized hook and a dorsal, double, heavily sclerotized hook so that the entire tenth tergite assemblage appears to be composed of three pairs of black hooks. Cerci flap-like and covered with long, scattered setae. Claspers short, more or less fused, with the ninth segment and apical margin incised to form a pair of lateral, flap-like lobes and a wide, mesal lobe angularly incised on the meson. Closely attached to each clasper is a heavily sclerotized structure with a wide, foot-like base and a stout, heavily sclerotized, apical portion which is produced beak-like beyond the rest of the genitalia; the true homology of this sclerite is doubtful. Aedeagus short and stout, consisting of a cup-like, sclerotized base which blends with an apical portion of membranous folds bearing at its apex a pair of sclerotized plates; within this structure is a sclerotized rod produced at apex into a pair of wing-like flanges which project dorso-laterad from the axis of the rod.

Holotype.—Male; Swim, Oregon; July 12, 1938; (K. Gray & J. Schuh).

Paratype.—1 ♂; Pitt Meadows, British Columbia; June, 1923; (W. A. Salter); [MCZ].

Platycentropus indicans (Walker)

NEW JERSEY: Cape May; June, 1934, (Witmer Stone), 3 ♂; June 14, 1933, (Witmer Stone), 2 ♂, 4 ♀: June 26, 1934, 2 ♀: June 15, 1937, 1 ♀: 1932, 1 ♀: [all ANSP].

PENNSYLVANIA: Buffalo Flats, between Buffalo & Branch Mountain, 5 miles northwest Hartleton, Union County; July 30–August 1, 2600 ft. alt., (Rehn, Pate & Rehn), 1 ♀, [ANSP].

Glyphotaelius hostilis Hagen

NEW HAMPSHIRE: New London; August 11–15, 1929, (F. Haimbach), 1 ♀, [ANSP].

Pycnopsyche guttifer (Walker)

MINNESOTA: Beaver River, Lake County; (Witmer Stone), August 12, 1911, 1 ♂, [ANSP].

MONTANA: 1 ♂, [ANSP].

W[ASHINGTON] T[ERRITORY]: 4 ♂, 1 ♀, [ANSP].

Pycnopsyche subfasciatus (Say)

PENNSYLVANIA: York; (George Miller), 1 ♂, [ANSP].

Pycnopsyche scabripennis (Rambur)

NEW JERSEY: Pitman; Aug. 24, 1908, 1 ♂, [ANSP].

Glyphopsyche avigo new species (Pl. XII, fig. 91.)

The structure of the genitalia indicates this species to be most closely related to *pritus* Milne, but it may be readily separated from this and other allied species by the wide lateral lobes of the claspers and the wide tenth tergite with its high, sharp, triangular, dorsal projection.

Male. Length 24 mm. Color of head, body, and appendages light brown with the following exception: spines on legs black; wings with anterior half light brown, stigma reddish-brown and darker brown streaks through the discal cell and cells R_2 and R_3, a chocolate-brown stripe running from base of wing including the medial cells and a line above, this chocolate-brown area fading off into the anal cells, and interrupted just beyond the mediocubital crossvein. General structure typical for genus. Maxillary palpi with second segment shorter than third, as three is to four, the third equal to the second dorsal segment of the front leg. Head without macrochaetae, the area meso-caudad of the lateral ocelli with a poorly defined group of six to eight setae of various lengths. Scutar warts small, ovoid, with about eight stout setae. Scutellum with a pair of rows of about six macrochaetae each. Spur count of legs 1–3–3, all segments of the legs provided in addition with black spines except for the apical segment of the tarsi. Venation typical for genus, with a well defined stigmal area in the front wing and the cross veins aligned to form a short, radio-medial cord, and, markedly basad of it, a medio-cubital cord. Eighth tergite with a large pair of black scabrous cushions.

Genitalia as in figure 91. Ninth segment contorted, with the dorsal portion inverted and held within the eighth segment, the ventral portion usually projecting free and having a large excavation near the center of the lateral area. Tenth tergite with antero-dorsal portion membranous, apical and basal portions forming a broad sclerotized shelf which has a small, upturned, sclerotized tooth at each side and the apex produced dorsad into a sharp triangle bearing pairs of short setae on its posterior margin. From the base of the tenth tergite arise two cercus-like, clavate processes beset with scattered long setae. Claspers apparently fused with the ninth sternite, projecting as far posteriorad as the tenth tergite, incised to form two wide, lateral lobes and a mesal lobe which itself is divided by a short, mesal incision; a groove marks off a triangular mesal area which may represent the boundary of the ninth sternite.

Aedeagus very similar to other members of the genus, composed of a pair of slightly sinuate, stout, lateral rods and a central submembranous structure with a ventral sclerotized cushion, a pair of long, membranous flaps at the apex and a stout, internal, sclerotized tube bearing the penis.

Female. Length 22.0 mm. Similar in size, color, and general structure to male. Seventh sternite with the apical margin slightly swollen and covered with a dense mat of very fine setae. Eighth tergite simple. Eighth sternite with a reduced basal portion bearing a scattering of short setae, and a large, flat, apical portion with the apex truncate except for a median incision bearing a triangular tooth at its base. Ninth tergite incised down the meson to its base, forming a pair of lateral projections which are reduced to a narrow, triangular base at apex; the baso-ventral portion is produced into a flap which lies just above and slightly to one side of the eighth sternite; ninth sternite slightly convex, clothed with setae and forming a subquadrate plate with a raised basal lip. Tenth tergite joined near base of ninth, consisting of a pair of lateral, sclerotized processes armed with a few setae along the dorsum and excavated beneath. Bursa copulatrix somewhat heart-shaped, with a ventral pair of dark flanges and a distinct mesal tooth, opening between the apex of the eighth sternite and the base of the ninth.

Holotype.—Male; Troutdale, Multnomah County, Oregon; April 15, 1939; (S. G. Jewett, Jr.).

Allotype.—Female; same data as for holotype; [INHS].

Paratype.—1 ♀; same data as for allotype; [INHS].

Ecclisomyia conspersa Banks

CALIFORNIA: 1 ♂, [ANSP].

Ecclisomyia simulata Banks

OREGON: Strawberry Cr., Strawberry Mountains; Aug. 20, 1928, 4450 ft. alt., (Rehn & Hebard), 1 ♂, [ANSP].

Family SERICOSTOMATIDAE

Brachycentrus americanus Banks

NEW MEXICO: Ute Park, Cimarron Cañon, Colfax Co.; 7900 ft. alt., July 13, 1937; (Rehn, Pate & Rehn), 1 ♂, [ANSP].

Brachycentrus lateralis (Say)

PENN[SYLVANIA]: Evett; 4 ♂, [ANSP].

Brachycentrus numerosus (Say)

W[ASHINGTON] T[ERRITORY]: 18 ♂, 1 ♀, [ANSP].

Micrasema scissum McLachlan

The drawings of McLachlan's original description show clearly the diagnostic characters of this species. It approaches very closely both *bactro* Ross, from which it can be distinguished easily by having the sixth, seventh and eighth tergites entire, and the following species.

ALASKA: Point Barrow; July 14, 1898, (E. A. McIlhenny), 26 ♂, [ANSP].

Micrasema sprulesi new species (Pl. XII, fig. 92.)

This species differs from *scissum* McL., in the short tenth tergite, lack of a curved spur on the claspers, and in having a wide, truncate mesal projection at the apex of the sixth sternite.

Male. Length 6 mm. Color dark brown to black, the face, antennae and tibiae slightly lighter than the rest of the body. General structure typical for genus as regards spur count, wing venation, etc. Sixth sternite with an apico-mesal projection which is half length of sternite, twice as wide as long and truncate at apex.

Genitalia as in figure 92. Ninth segment annular, with a deep basal lobe on lateral margin. Tenth tergite short, divided into two sclerotized lobes, each bearing two or three stout setae on dorsal margin and a cluster of short setae at apex. Cerci widely separated by membranous folds, irregular in shape, somewhat pointed at apex and clothed with short setae. Claspers with base large, tapering to an apical portion with a wide, rounded lateral aspect; on the back of the clasper are two small lobes, an apical round one without setae and a larger one bearing a few setae and projecting more mesad. Aedeagus cylindrical and submembranous.

Female. Size, color and general structure as for male. Abdomen tubular, without definite external genital structures which are typical for genus. To date characters have not yet been discovered to separate the females of this genus.

Holotype.—Male; Costello Lake, Algonquin Park, Ontario, Ontario Fisheries Research Laboratory; June 12, 1939; (W. M. Sprules; cage #2).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—19♂, 1♀; same data as for holotype: 1♂; June 10, 1939: 8♂, 1♀; June 13, 1939: 22♂; June 15, 1939: 3♂, 5♀; June 17, 1939: 3♂, 2♀; June 18, 1939.

Paratypes are in the collections of the Illinois Natural History Survey and the Academy of Natural Sciences of Philadelphia.

Goerita genota new species (Pl. XIII, fig. 93.)

Many characters separate this species from *semata* Ross, the only other known species in this genus. These include additional facial warts, long and cylindrical palpi and differences in the genitalia. In the main generic characters the two are similar, so it does not seem advisable to erect a new genus for this aberrant species.

Male. Length 7 mm. Color black, the legs below femora lighter. General structure typical for genus as to venation, legs, and thoracic structure. Head with a pair of long, narrow warts near meson and two short pairs near eyes. Malar space large, on frontal aspect as long as eyes. Maxillary palpi with first segment short, second and third longer, subequal and cylindrical, without peculiar developments.

Genitalia as in figure 93. Ninth segment with ventral half broad, dorsal half suddenly constricted along anterior margin and small. Tenth tergite consisting of a mesal membranous area and two widely separated lateral arms, somewhat beaked, as seen from the side, and with a lateral expansion on the basal half, the apical portion finger-like and bearing a few scattered setae. It is very probable that the lateral expansion represents the cerci. Claspers two-segmented; basal segment large and robust, the meso-ventral corner produced posteriorad and mesad into a sharp, heavily sclerotized point, the remainder of the segment clothed with a scattering of long setae; apical segment finger-like, semimembranous, very slightly curved with minute setae over most of the surface and a ventral area of longer setae directed meso-ventrad. Aedeagus tubular, the tube varying in width, widest at apex, anchored by lateral sclerotized bands and containing a pair of sclerotized triangular bodies.

Female. Similar in size, color, and general structure to male. Genitalia as in figure 93B. Eighth segment simple with an irregular row of setae along the apical margin arranged in small warts. The tergite with an irregular wart-like area occupying most of the mesal and apical portion of the segment and bearing scattered setae. Eighth sternite sclerotized, the entire mesal portion excavated to form a large, wide "U," the lateral portions distinct on each side and joined by a very narrow basal strap. Ninth tergite hood-like, with a pair of apical flat lobes. Ninth sternite with narrow lateral portions and with a ventral sclerite which occupies most of the U-shaped excavation of the eighth sternite and is produced into an apical, broad, rounded lobe to meet the appressed ends of the lateral portion of the ninth.

Holotype.—Male; Troutdale, Multnomah County, Oregon; April 15, 1939; (S. G. Jewett, Jr.).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—7 ♂; same data as for holotype. 1 ♂; Tidewater, Oregon; April 21, 1935; (J. Schuh).

Paratypes are in the collections of the Illinois Natural History Survey, S. G. Jewett, Jr., and The Academy of Natural Sciences of Philadelphia.

Lepidostoma podager McL.

CALIFORNIA: Lagunitas Canon, Marin Co.; March 28, 1908, (E. T. Cresson, Jr.), 1 ♂, [ANSP].

Lepidostoma roafei (Milne)

NEW MEXICO: Beulah; (H. Skinner), 1 ♂, [ANSP].

Lepidostoma rayneri new species (Pl. XIII, fig. 96.)

This species is most closely related to *pluvialis* Milne, differing in the tenth tergite which has the lateral margins produced into a lobe bearing a small dorsal and ventral spur at the apex. In *pluvialis* (Fig. 95), the dorsal spur is small and set back from the apex of the lateral lobe and the ventral spur is large and incurved.

Male. Length 8.5 mm. Head, basal segment of antennae, thorax, coxae, and abdomen a medium dark shade of brown; antennae, legs below coxae, and palps light yellowish-brown; wing membrane almost hyaline, faintly tawny; scales beyond head and under reflexed portion of front wing black.

General structure typical for subgenus *Olemira.* Antennae with basal segment equal in length to dorsal width of head, the mesal margin very thickly haired, and the basal half of the mesal margin clothed with a thick cluster of long, black scales. Dorsum of head above base of antennae, also with a cluster of black scales. Maxillary palpi with basal segments small, second segment about as long as apical segment of labial palpi and clothed with long, thin hairs; third segment shorter than second and bearing a thick brush of long scales so that altogether it appears subequal to the second. Front wings with costal cells reflexed and folded back almost to stem of media. Remainder of venation, structure, and spur arrangement of legs, etc., as for other members of the group.

Genitalia as in figure 96. Ninth segment annular, the dorso-mesal margin produced into a triangular projection. Tenth tergite divided into two lateral lobes, separated on the meson for their entire length, and appearing from above like two, out-curved, concave plates. From lateral view are seen a more or less amorphous basal fold and a wide more or less truncate apical margin which bears a small ventral spur and an inconspicuous dorsal lobe, bearing another upturned dark spur which is entirely or almost in line with the ventral one.

Claspers narrow and long, with a finger-like basal projection, seen from the side; the ventral view has the basal half wide and flat, narrowing suddenly to the apical portion which has an apical lobe truncate and a small, pointed, finger-like projection arising from the mesal face near the ventral margin; the body of the claspers is clothed with dense hair, the two finger-like projections with scattered setae and apical truncate lobe with very fine and inconspicuous setae. Aedeagus long, tubular, and arcuate, the apex submembranous and with a pair of long, flat, arcuate plates appressed to the dorsal surface.

Female. Length 8 mm. Color and general structure similar to male except for lack of reflexed area of the front wing and complete absence of black scales on the body. First antennal segment very long and slender, slightly shorter than the width of the head as 4.5 is to 5.0, its inner margin clothed with very long hair. Female genitalia typical for subgenus *Olemira;* seventh sternite practically unmodified but apical margin arcuately emarginate; eighth tergite unmodified, with a single row of about a dozen setae along the apical margin on each side of the meson; sternite with a wide, stout, small, Y-shaped sclerotized area; ninth tergite rounded, emarginate at the apex; tenth tergite short and forming a simple lobe. Bursa copulatrix as for other species of the subgenus.

Holotype.—Male; Convict Creek, Mono County, California; August 1, 1938; (H. J. Rayner).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—1 ♂, 1 ♀; same data as for holotype. 1 ♂; Molalla, Molalla River, Clackamas County, Oregon; July 1, 1935; (S. G. Jewett, Jr.).

Paratypes are in the collections of Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Lepidostoma cantha new species (Pl. XIII, fig. 94.)

This species is most closely related to those of the *Olemira* group, especially *pluvialis,* but differs from this species and its allies by the very small amount of reflection of the costal cell and the stout, baso-ventral, sclerotized horns of the tenth tergite.

Male. Length 8.5 mm. Color dark brown, the antennae, wings, and legs below coxae, tawny; scales on head and wings black. Structure as for *rayneri* with the following differences: first antennal segment bearing a cushion of black setae on the mesal margin extending from base to almost apex; apical segment of maxillary palpi short and held at an obtuse angle to the second segment where brush is flared out; costal cell reflexed scarcely more than the thickness of the vein, the reflexed portion extending only half the length of the subcostal cell; the pouch formed by this reflection, the furrow of the costal and subcostal cells, the central portion of the front wing, and the principal veins of the hindwing clothed with a moderate number of black scales.

Genitalia as in figure 94. Ninth segment almost completely even and annular except for a slight emargination and projection of the dorso-mesal margin. Tenth tergite divided into two halves by a mesal fissure, each consisting of (1) a meso-dorsal lobe bearing a scattering of setae at the apex and a flange-like upturning of the apico-lateral margin, and (2) a ventro-lateral arm which forms a short and stubby lateral knob bearing a few setae and a heavily sclerotized hook which curves mesad and then back laterad, most of the hook being concealed beneath the body of the segment, from a dorsal view. Claspers simple, long, and tapering towards apex, clothed with bushy hair, with a short, finger-like projection above extreme base and a poorly separated apical portion which is obliquely truncate at apex and clothed with only fine setae. Aedeagus long and arcuate with a pair of heavily sclerotized plates situated on the dorsal surface.

Female. Length 8.2 mm. Color and general structure identical for male. Genitalia similar to those described for *rayneri,* including the broad, squatty, "Y" mark on the eighth sternite. To date diagnostic characters have not been found to separate the females of this group.

Holotype.—Male; near small, slow stream, Hastings Natural History Reservation, Monterey County, California; May 24, 1938; (C. D. Michener; at light).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—16 ♂, 16 ♀; same data as for holotype.

Paratypes are in the collections of the Illinois Natural History Survey, the California Academy of Sciences, and The Academy of Natural Sciences of Philadelphia.

Lepidostoma ontario new species (Pl. XIII, fig. 98.)

This species is most closely related to *cantha* Ross, but differs from it in the long, scimitar-like, lateral lobes of the tenth tergite.

Male. Length 8.5 mm. Color various shades of medium to dark brown, the palps, apical segments of legs, and wings lighter. General structure typical for genus with the following noteworthy characters: dorsal aspect of head three times as wide as long, with a large wart connecting caudal margin and mesal margin of eye and with a small, round wart at base of each antennae. Basal segment of antennae subequal in length to mesal length of head, clothed with relatively short and scattered hair. Maxillary palps with first segment minute, second large and about as long and stout as first antennal segment, third either retracted within pouch of second or consisting of a finger-like core clothed with black scales. Structure and spur arrangement of legs and venation of wings unmodified from the simple type of the genus.

Genitalia as in figure 98. Ninth segment annular, but narrowed near dorsal margin, enlarged above this point into a pair of slightly projecting lobes; ventral half wide and projecting almost as far caudad as apex of tenth tergite. Tenth tergite forming a pair of blunt lobes separated to near base where they fuse with the ninth tergite; the lobes are set with sparse setae and the dorsal mesal surface is drawn up into a number of small, spur-like projections and from the base of each lobe arises a large, semi-sclerotized, scimitar-like process which is curved mesad and extends considerably beyond the apex of the tenth. Claspers, seen from ventral view, with base sharply angled, ventral lobe stocky, very hairy, and with a meso-dorsal lobe which is short, ovate, and clothed with only minute setae; the dorsal lobe is spatulate and extends beyond the ventral lobe and is clothed with long setae along the lateral margin. Aedeagus small, only slightly longer than the tenth tergite; arcuate, with an enlarged base, constricted center and slightly enlarged apex.

Female. Length 8 mm. Color and general structure similar to male except for the genitalia. Genitalia similar to those of *rayneri* except for the eighth sternite which has a clavate sclerite on each lateral margin connected by a narow sclerotized band with a quadrate central sclerite incised two-thirds of its distance down the meson.

Holotype.—Male; Costello Lake, Algonquin Park, Ontario, Ontario Fisheries Research Laboratory; May 29, 1938; (W. M. Sprules; station #2).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—2 ♂, 2 ♀; Randolph, New Hampshire; June 25, 1930. 3 ♂; same data as for holotype, but May 30, 1938: 1 ♀; May 31: 1 ♂; May 26.

Paratypes are in the collections of the Illinois Natural History Survey, the Museum of Comparative Zoology, and The Academy of Natural Sciences of Philadelphia.

Lepidostoma liba new species (Pl. XIII, fig. 97.)

This species is most closely related to *vernalis* (Banks) but differs from it in the different shape of the lobes of the tenth tergite.

Male. Length 8.5 mm. Color various shades of brown, the dorsum darker, the antennae, legs, and ventral portions much lighter, often tawny. Structure of head almost identical with previous species except for the antero-mesal warts which are slightly larger and more or less triangular. Tergites six, seven, and eight, with the apical half membranous and a large cushion of very long, white setae situated at each side of the membranous portion. Maxillary palpi small and short, the divisions between the segments obliterated, the inner surface concave and bare, the outer surface clothed with long, thin hair. Legs and wings unmodified from the primitive type for the genus.

Male genitalia as in figure 97. Ninth segment annular and regular, the dorsal surface bearing a pair of cushions of very long, white setae which extend over and beyond the tenth tergite. Tenth tergite composed of two parts: (1) a mesal pair of triangular, membranous and relatively indistinct lobes devoid of vestiture; and (2) a pair of lateral, sclerotized arms bearing a few setae at apex and with the apex irregular and more or less incised. Claspers with a broad and only slightly convex ventral surface, the apical margin irregular and somewhat obliquely truncate; seen from the side, it has a broad base which narrows to a shallower, toothed, apical lobe; from the lateral side of the base arises a tapered, pointed process bearing a few scattered setae and a few long ones at apex; from the dorso-mesal corner of the base arises a stout, sclerotized rod which is sharply curved caudad and whose apex runs just beneath the tergite.

Aedeagus short, arcuate, the base somewhat bulbous and the apex semimembranous with some embedded sclerites.

Female. Length 9.0 mm. Color and general structure typical for genus except for antigenetic characters. First antennal segment slightly longer than mesal length of head, as five is to four. Sixth, seventh, eighth, and ninth tergites with a lanceolate cushion of long setae at each apico-lateral corner. Eighth sternite practically colorless without any conspicuous sclerites. The apical portion concave, narrowed and incised at extreme apex. Bursa copulatrix as in figure 97C.

Holotype.—Male; stream in Botanical Garden, Elgin, Illinois; June 6, 1939; (Burks & Riegel).

Allotype.—Female; same data as for holotype; [INHS].

Paratypes.—1 ♀; same data as for holotype, but June 13, 1939; (Frison & Ross), 1 ♀; same data as for allotype. 3 ♂, 37 ♀; Quincy, Cave Springs, Illinois; September 15, 1939; (Ross & Riegel). 1 ♀; spring at McCann school, LaRue, Illinois; May 12, 1939; (Burks & Riegel).

Paratypes are in the collections of the Illinois Natural History Survey and The Academy of Natural Sciences of Philadelphia.

Helicopsyche arizonensis Banks

ARIZONA: Huachuca Mountains; Aug., 1905, (H. Skinner), 4 ♂, 1 ♀, [ANSP].

Helicopsyche borealis Hagen

ARKANSAS: Five miles north of Jasper, Newton County; 1000 ft. alt., Aug. 11, 1939, (Rehn & Rehn), 24 ♂, [ANSP].

EXPLANATION OF FIGURES

PLATE I

Fig. 1.—*Rhyacophila blarina* new species. ♂ genitalia, lateral aspect; A, ♂ tenth tergite; B, aedeagus, lateral aspect.

Fig. 2.—*Rhyacophila ecosa* new species. ♂ genitalia, lateral aspect; A, ♂ tenth tergite; B, aedeagus, ventral aspect; C, eadeagus, lateral aspect.

Fig. 3.—*Rhyacophila mycta* new species. ♂ genitalia, lateral aspect; A, ♂ tenth tergite.

Fig. 4.—*Rhyacophila oreta* new species. ♂ genitalia, lateral aspect.

Fig. 5.—*Rhyacophila phryganea* new species. ♂ genitalia, lateral aspect; A, aedeagus, lateral aspect.

Fig. 6.—*Glossosoma idaho* new species. ♂ genitalia, lateral aspect.

Fig. 7.—*Glossosoma montana* new species. ♂ genitalia, lateral aspect.

Fig. 8.—*Glossosoma pyroxum* new species. ♂ genitalia, lateral aspect.

Fig. 9.—*Agapetus tomus* new species. ♂ genitalia, lateral aspect.

Fig. 10.—*Agapetus vireo* new species. ♂ genitalia, lateral aspect; A, clasper, ventral aspect.

PLATE II

Fig. 11.—*Agapetus vireo* new species. ♀ genitalia, lateral aspect.

Fig. 12.—*Protoptila balmorhea* new species. ♂ genitalia, lateral aspect; A, ♂ eighth sternite.

Fig. 13.—*Protoptila coloma* new species. ♂ genitalia, lateral aspect.

Fig. 14.—*Protoptila alexanderi* new species. ♂ genitalia, lateral aspect; A, lateral style of aedeagus.

Fig. 15.—*Protoptila palina* new species. ♂ genitalia, lateral aspect; A, lateral style of aedeagus; B, ♀ genitalia, ventral aspect.

Fig. 16.—*Protoptila lega* new species. ♂ genitalia, lateral aspect; A, lateral style of aedeagus; B, ♀ genitalia, ventral aspect.

Fig. 17.—*Chimarrha feria* new species. ♂ genitalia, lateral aspect; A, claspers, ventral aspect.

PLATE III

Fig. 18.—*Dolophilus anillus* new species. ♂ genitalia, lateral aspect.

Fig. 19.—*Oxyethira aculea* new species. ♂ genitalia, lateral aspect; A, ♂ genitalia, dorsal aspect; B, aedeagus.

Fig. 20.—*Polytrichia mono* new species. ♂ genitalia, lateral aspect; A, claspers, ventral aspect; B, ♂ tenth tergite, lateral aspect.

Fig. 21.—*Polytrichia arva* new species. ♂ genitalia, lateral aspect; A, claspers, ventral aspect.

Fig. 22.—*Polytrichia eliaga* new species. ♂ genitalia, lateral aspect; A, claspers, ventral aspect.

Fig. 23.—*Polytrichia logana* new species. ♂ genitalia, lateral aspect; A, claspers, ventral aspect; B, ♂ tenth tergite, dorsal aspect; C, ♀ eighth sternite.

Fig. 24.—*Polytrichia lometa* new species. ♂ genitalia, lateral aspect; A, ♂ tenth tergite, dorsal aspect.

Fig. 25.—*Polytrichia unio* new species. ♂ genitalia, dorsal aspect; A, ♂ tenth tergite, dorsal aspect; B, ♂ genitalia, lateral aspect.

Plate IV

Fig. 26.—*Polytrichia contorta* new species. ♂ tenth tergite, dorsal aspect.

Fig. 27.—*Polytrichia anisca* new species. ♂ tenth tergite, dorsal aspect.

Fig. 28.—*Loxotrichia glasa* new species. ♂ genitalia, lateral aspect; A, ♂ genitalia, ventral aspect.

Fig. 29.—*Neotrichia kitae* new species. ♂ genitalia, lateral aspect; A, bursa copulatrix; B, ♀ eighth sternite; C, ♂ genitalia, ventral aspect; D, aedeagus.

Fig. 30.—*Neotrichia riegeli* new species. ♂ genitalia, ventral aspect; A, aedeagus; B, bursa copulatrix; C, ♀ eighth sternite.

Fig. 31.—*Neotrichia edalis* new species. ♂ genitalia, lateral aspect; A, ♂ genitalia, ventral aspect; B, aedeagus.

Plate V

Fig. 32.—*Hydroptila acadia* new species. ♂ genitalia, lateral aspect; A, ♂ genitalia, dorsal aspect; B, aedeagus; C, ♀ eighth sternite; D, ♀ eighth tergite.

Fig. 33.—*Hydroptila waubesiana* Betten. ♀ eighth tergite.

Fig. 34.—*Hydroptila pecos* new species. ♂ genitalia, lateral aspect; A, claspers, ventral aspect; B, ♂ tenth tergite; C, aedeagus.

Fig. 35.—*Hydroptila xella* new species. ♂ genitalia, lateral aspect; A, ♂ genitalia, ventral aspect; B, aedeagus; C, ♀ eighth sternite.

Fig. 36.—*Hydroptila rono* new species. ♂ genitalia, lateral aspect; A, aedeagus; B, ♂ genitalia, ventral aspect; C, ♀ eighth sternite.

Plate VI

Fig. 37.—*Hydroptila salmo* new species. ♂ genitalia, ventral aspect; A, aedeagus.

Fig. 38.—*Hydroptila berneri* new species. ♂ genitalia, lateral aspect; A, claspers, ventral aspect; B, ♀ genitalia, ventral aspect; C, apex of ♀ eighth tergite; D, aedeagus, from two angles.

Fig. 39.—*Hydroptila nicoli* new species. ♂ genitalia, lateral aspect; A, aedeagus; B, ♂ genitalia, dorsal aspect; C, ♀ eighth tergite.

Fig. 40.—*Hydroptila strepha* new species. ♂ genitalia, lateral aspect; A, claspers, ventral aspect; B, aedeagus.

Fig. 41.—*Polycentropus nascotius* new species. ♂ genitalia, lateral aspect; A, claspers, ventral aspect.

Fig. 42.—*Polycentropus confusus* Hagen. Aedeagus, lateral aspect.

Fig. 43.—*Polycentropus centralis* Banks. Aedeagus, lateral aspect.

Fig. 44.—*Polycentropus nascotius* new species. Aedeagus, lateral aspect.

PLATE VII

Fig. 45.—*Polycentropus pentus* new species. ♂ genitalia, lateral aspect.

Fig. 46.—*Polycentropus confusus* Hagen. ♂ genitalia, lateral aspect.

Fig. 47.—*Polycentropus centralis* Banks. ♂ genitalia, lateral aspect.

Fig. 48.—*Polycentropus carolinensis* Banks. ♂ genitalia, lateral aspect.

Fig. 49.—*Polycentropus pentus* new species. Aedeagus, lateral aspect.

Fig. 50.—*Polycentropus pentus* new species. Claspers, ventral aspect.

Fig. 51.—*Polycentropus pentus* new species. Basal process of clasper.

Fig. 52.—*Polycentropus centralis* Banks. Basal process of clasper.

Fig. 53.—*Polycentropus confusus* Hagen. Basal process of clasper.

Fig. 54.—*Polycentropus carolinensis* Banks. Basal process of clasper.

Fig. 55.—*Polycentropus maculatus* Banks. Basal process of clasper.

Fig. 56.—*Polycentropus charlesi* new species. ♂ genitalia, lateral aspect; A, claspers, ventral aspect; B, aedeagus, lateral aspect.

Fig. 57.—*Polycentropus colei* new species. ♂ genitalia, lateral aspect; A, claspers, ventral aspect; B, aedeagus, dorsal aspect.

Fig. 58.—*Polycentropus iculus* new species. ♂ genitalia, lateral aspect; A, aedeagus, dorsal aspect; for parts numbered 1, 2, and 3 see text.

Fig. 59.—*Cernotina astera* new species. ♂ genitalia, lateral aspect; A, ♂ genitalia, dorsal aspect.

PLATE VIII

Fig. 60.—*Aphropsyche aprilis* new species. ♂ wings; A, aedeagus, dorsal aspect; B, ♂ genitalia, lateral aspect.

Fig. 61.—*Oropsyche howellae* new species. ♂ wings; A, aedeagus, ventral aspect; B, ♂ genitalia, lateral aspect; C, ♂ tenth tergite.

Fig. 62.—*Cheumatopsyche etrona* new species. ♂ genitalia, lateral aspect; A, clasper, caudal aspect; B, ♂ tenth tergite, caudal aspect; C, ♂ tenth tergite, dorsal aspect.

Fig. 63.—*Cheumatopsyche pinaca* new species. ♂ genitalia, lateral aspect; A, clasper, caudal aspect; B, ♂ tenth tergite, dorsal aspect; C, ♂ tenth tergite, caudal aspect.

Fig. 64.—*Cheumatopsyche mollala* new species. ♂ genitalia, lateral aspect; A, clasper, caudal aspect; B, ♂ tenth tergite, caudal aspect.

Fig. 65.—*Cheumatopsyche pasella* new species. ♂ genitalia, lateral aspect; A, clasper, caudal aspect; B, ♂ tenth tergite, caudal aspect.

PLATE IX

Fig. 66.—*Cheumatopsyche burksi* new species. ♂ genitalia, lateral aspect; A, clasper, caudal aspect; B, ♂ tenth tergite, caudal aspect.

Fig. 67.—*Hydropsyche delrio* new species. ♂ genitalia, lateral aspect; A, apex of aedeagus, lateral aspect; B, apex of aedeagus, ventral aspect.

Fig. 68.—*Hydropsyche demora* new species. ♂ genitalia, lateral aspect; A, apex of aedeagus, lateral aspect; B, apex of aedeagus, ventral aspect.

Fig. 69.—*Hydropsyche placoda* new species. ♂ genitalia, lateral aspect; A, apex of aedeagus, ventral aspect.

Fig. 70.—*Hydropsyche fattigi* new species. ♂ genitalia, lateral aspect; A, apex of aedeagus, lateral aspect; B, apex of aedeagus, ventral aspect.

Fig. 71.—*Hydropsyche philo* new species. ♂ genitalia, lateral aspect; A, apex of aedeagus, ventral aspect.

Fig. 72.—*Hydropsyche venada* new species. ♂ genitalia, lateral aspect; A, aedeagus, lateral aspect.

Fig. 73.—*Hydropsyche ventura* new species. Aedeagus, lateral aspect; A, apex of aedeagus, ventral aspect; B, lateral appendages of aedeagus, greatly enlarged.

Fig. 74.—*Athripsodes wetzeli* new species. ♂ genitalia, lateral aspect; A, clasper, caudal aspect; B, aedeagus, lateral aspect.

PLATE X

Fig. 75.—*Athripsodes miscus* new species. ♂ genitalia, lateral aspect; A, clasper, caudal aspect; B, aedeagus, lateral aspect.

Fig. 76.—*Athripsodes alces* new species. ♂ genitalia, lateral aspect; A, aedeagus, lateral aspect.

Fig. 77.—*Triaenodes nox* new species. ♂ genitalia, lateral aspect; A, claspers, ventral aspect.

Fig. 78.—*Triaenodes florida* new species. ♂ genitalia, lateral aspect; A, claspers, ventral aspect.

Fig. 79.—*Oecetis georgia* new species. ♂ genitalia, lateral aspect; A, claspers, ventral aspect; B, *Oecetis sphyra* new species, ♂ genitalia, lateral aspect; C, *Oecetis sphyra,* aedeagus, both lateral aspects.

Fig. 80.—*Leptocerus stehri* new species. ♂ genitalia, lateral aspect; A, ♂ tenth tergite, dorsal aspect; B, ♀ genitalia, lateral aspect; C, ♀ genitalia, ventral aspect.

PLATE XI

Fig. 81.—*Lepania cascada* new species. ♂ wings; A, ♂ genitalia, lateral aspect; B, bursa copulatrix; C, ♀ genitalia, ventral aspect; D. ♂ genitalia, dorsal aspect; E, ♂ genitalia, ventral aspect.

Fig. 82.—*Radema sorex* new species. ♂ genitalia, lateral aspect; A, ♂ genitalia, ventral aspect; B, ♂ tenth tergite, dorsal aspect.

Fig. 83.—*Oligophlebodes ardis* new species. ♂ genitalia, lateral aspect; A, ♀ genitalia, ventral aspect; B, ♂ genitalia, dorsal aspect.

Fig. 84.—*Limnephilus ectus* new species. ♂ genitalia, lateral aspect; A, cercus, mesal aspect; B, aedeagus, lateral aspect.

Fig. 85.—*Limnephilus labus* new species. ♂ genitalia, lateral aspect; A, ♀ genitalia, ventral aspect; B, aedeagus, lateral aspect.

Fig. 86.—*Limnephilus lunonus* new species. ♂ genitalia, lateral aspect; A, aedeagus, lateral aspect.

PLATE XII

Fig. 87.—*Limnephilus arizona* new species. ♂ genitalia, lateral aspect; A, ♂ genitalia, dorsal aspect; B, ♀ genitalia, dorsal aspect.

Fig. 88.—*Limnephilus taronus* new species. ♂ genitalia, lateral aspect; A, ♂ genitalia, dorsal aspect; B, ♀ genitalia, ventral aspect; C, ♀ genitalia, lateral aspect.

Fig. 89.—*Philocasca demita* new species. ♂ genitalia, lateral aspect; A, ♂ genitalia, dorsal aspect; B, aedeagus, lateral aspect.

Fig. 90.—*Homophylax andax* new species. ♂ genitalia, lateral aspect; A, ♂ genitalia, dorsal aspect; B, aedeagus, lateral aspect; C, claspers, ventral aspect.

Fig. 91.—*Glyphopsyche avigo* new species. ♂ genitalia, lateral aspect; A, ♂ tenth tergite, dorsal aspect; B, claspers, ventral aspect; C, ♀ genitalia, ventral aspect.

Fig. 92.—*Micrasema sprulesi* new species. ♂ genitalia, lateral aspect; A, clasper, caudal aspect.

PLATE XIII

Fig. 93.—*Goerita genota* new species. ♂ genitalia, lateral aspect; A, ♂ genitalia, ventral aspect; B, ♀ genitalia, ventral aspect.

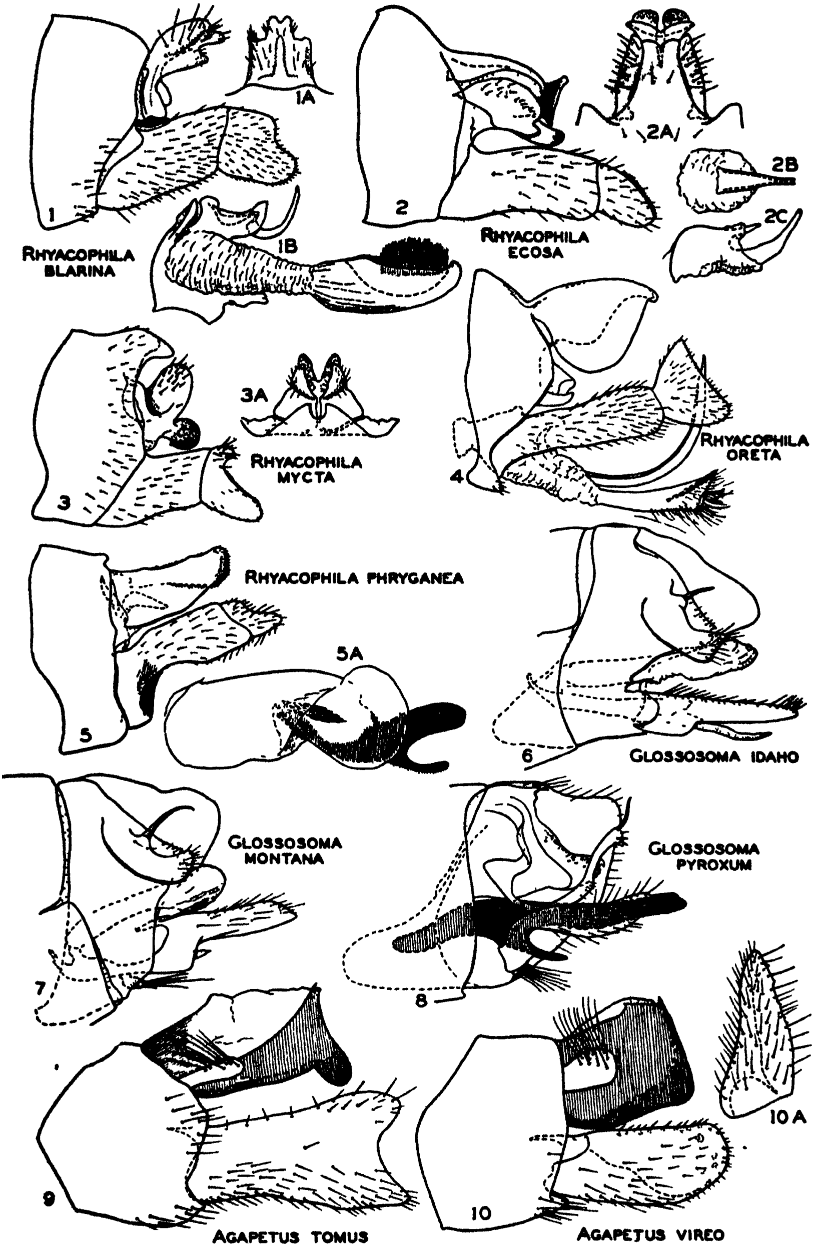
Fig. 94.—*Lepidostoma cantha* new species. ♂ genitalia, lateral aspect; A, ♂ tenth tergite, dorsal aspect.

Fig. 95.—*Lepidostoma pluvialis* Milne. ♂ genitalia, lateral aspect; A, ♂ tenth tergite, dorsal aspect.

Fig. 96.—*Lepidostoma rayneri* new species. ♂ genitalia, lateral aspect; A, ♂ tenth tergite, dorsal aspect.

Fig. 97.—*Lepidostoma liba* new species. ♂ genitalia, lateral aspect; A, ♂ tenth tergite, dorsal aspect; B, clasper, caudal aspect; C, bursa copulatrix; D, ♀ genitalia, ventral aspect.

Fig. 98.—*Lepidostoma ontario* new species. ♂ genitalia, lateral aspect; A, ♂ tenth tergite, dorsal aspect.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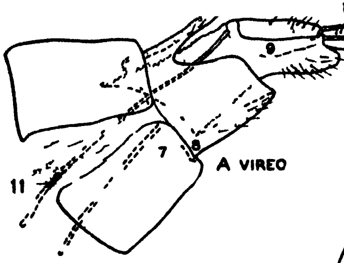
1A
1B
Rhyacophila blarina
2
2A
2B
2C
Rhyacophila ecosa
3
3A
Rhyacophila mycta
4
Rhyacophila oreta
5
5A
Rhyacophila phryganea
6
Glossosoma idaho
7
Glossosoma montana
8
Glossosoma pyroxum
9
Agapetus tomus
10
10A
Agapetus vireo



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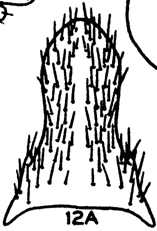

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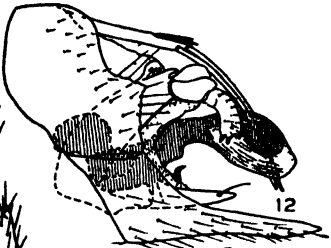

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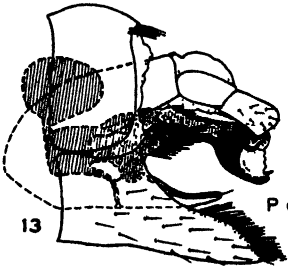

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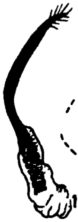
P COLOMA



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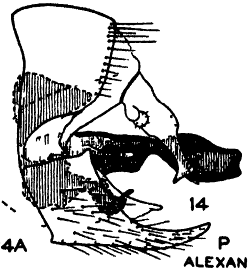

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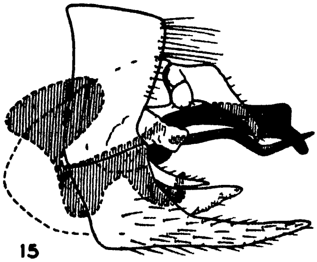

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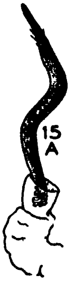

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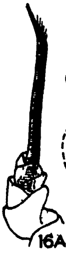

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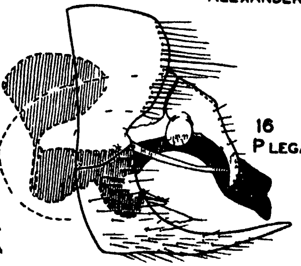

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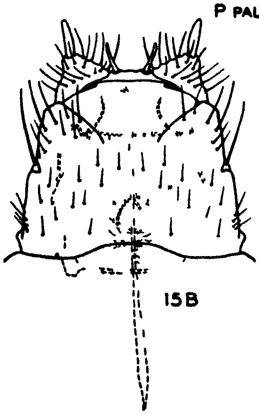

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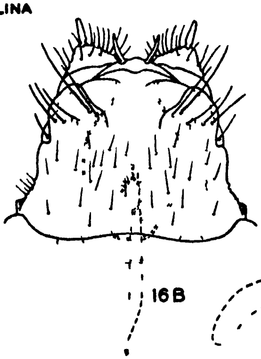

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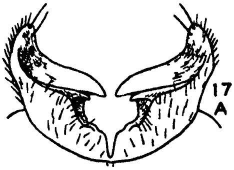

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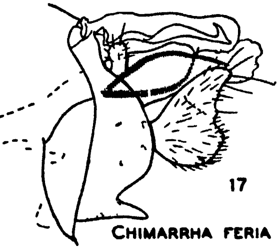

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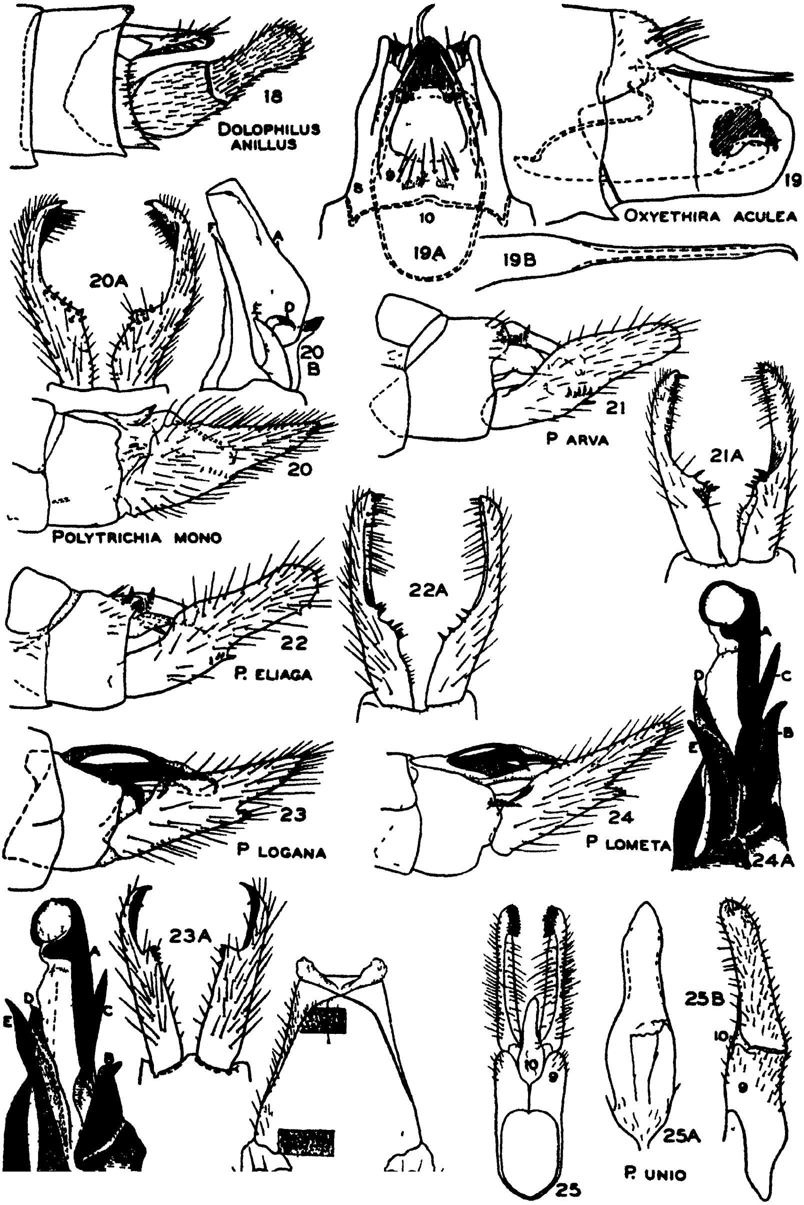
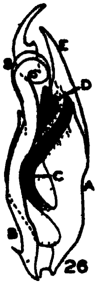
CHIMARRHA FERIA

ROSS—NORTH AMERICAN TRICHOPTERA



ROSS—NORTH AMERICAN TRICHOPTERA



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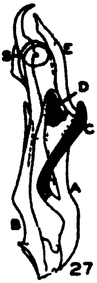
P. CONTORTA



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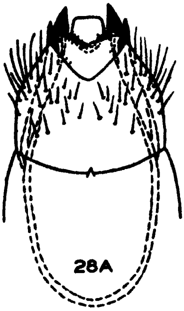
P. ANISCA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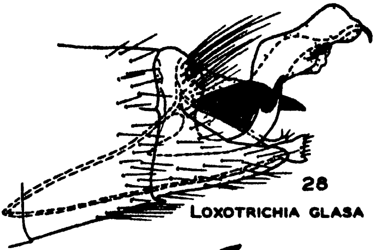
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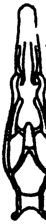
LOXOTRICHIA GLASA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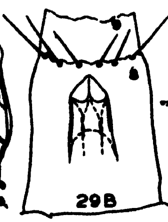

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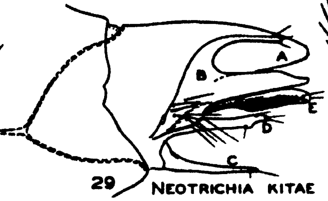

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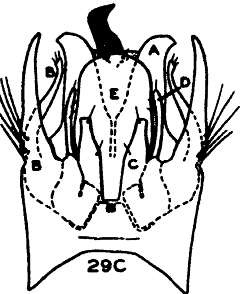
NEOTRICHIA KITAE



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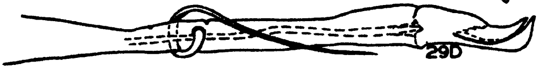
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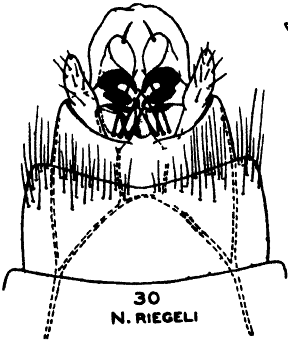
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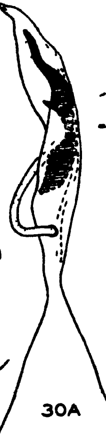
N. RIEGELI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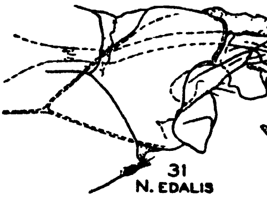
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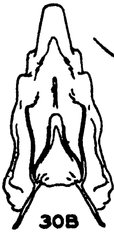
N. EDALIS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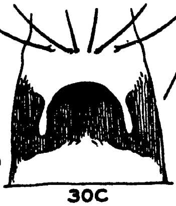
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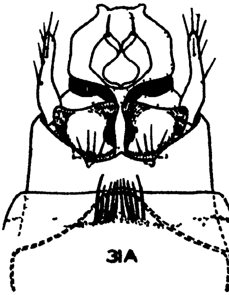
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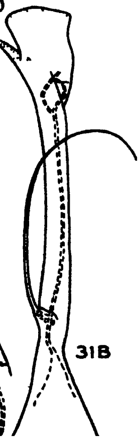
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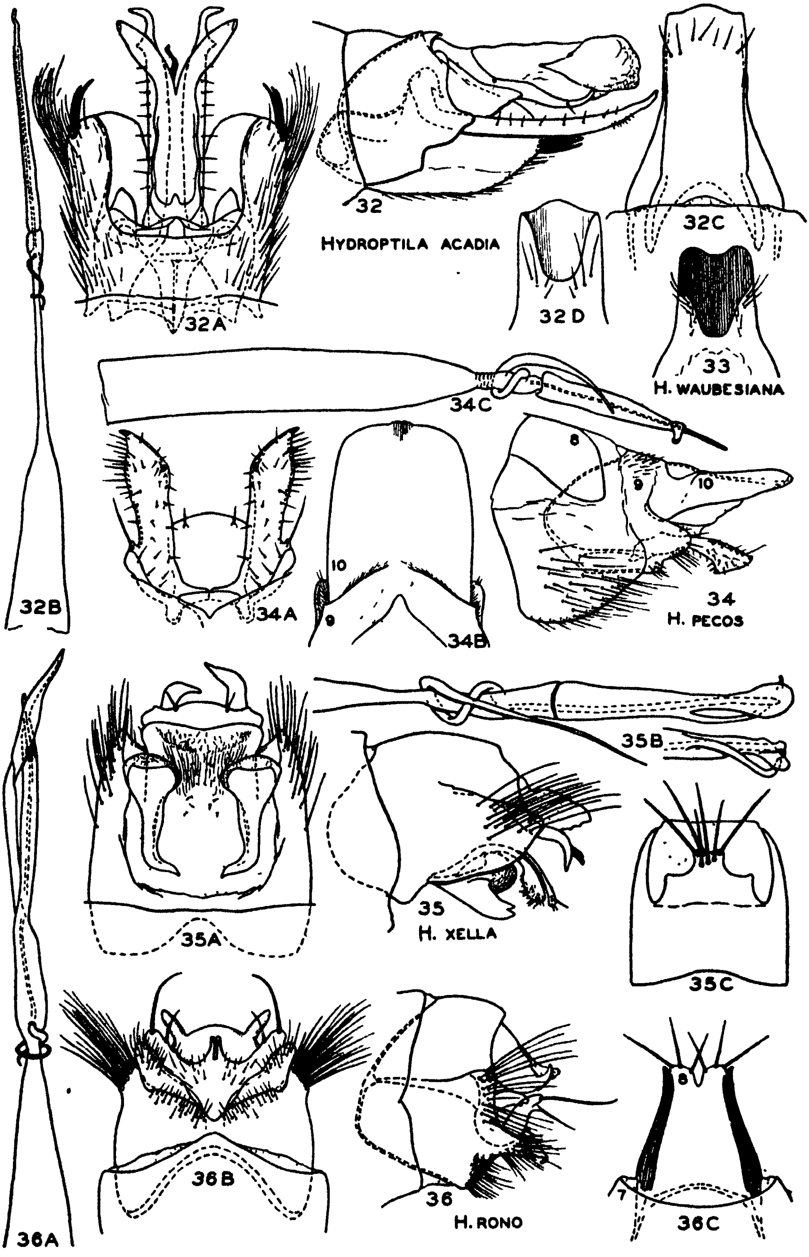

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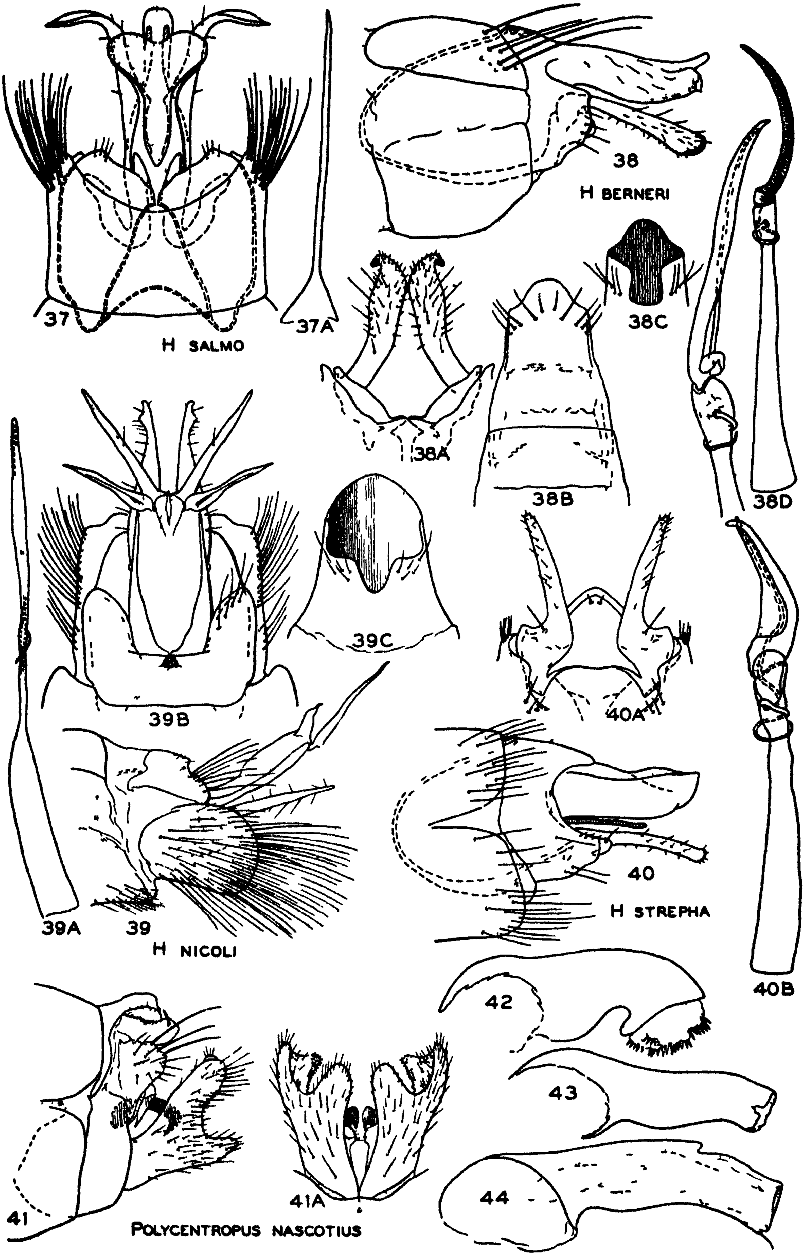

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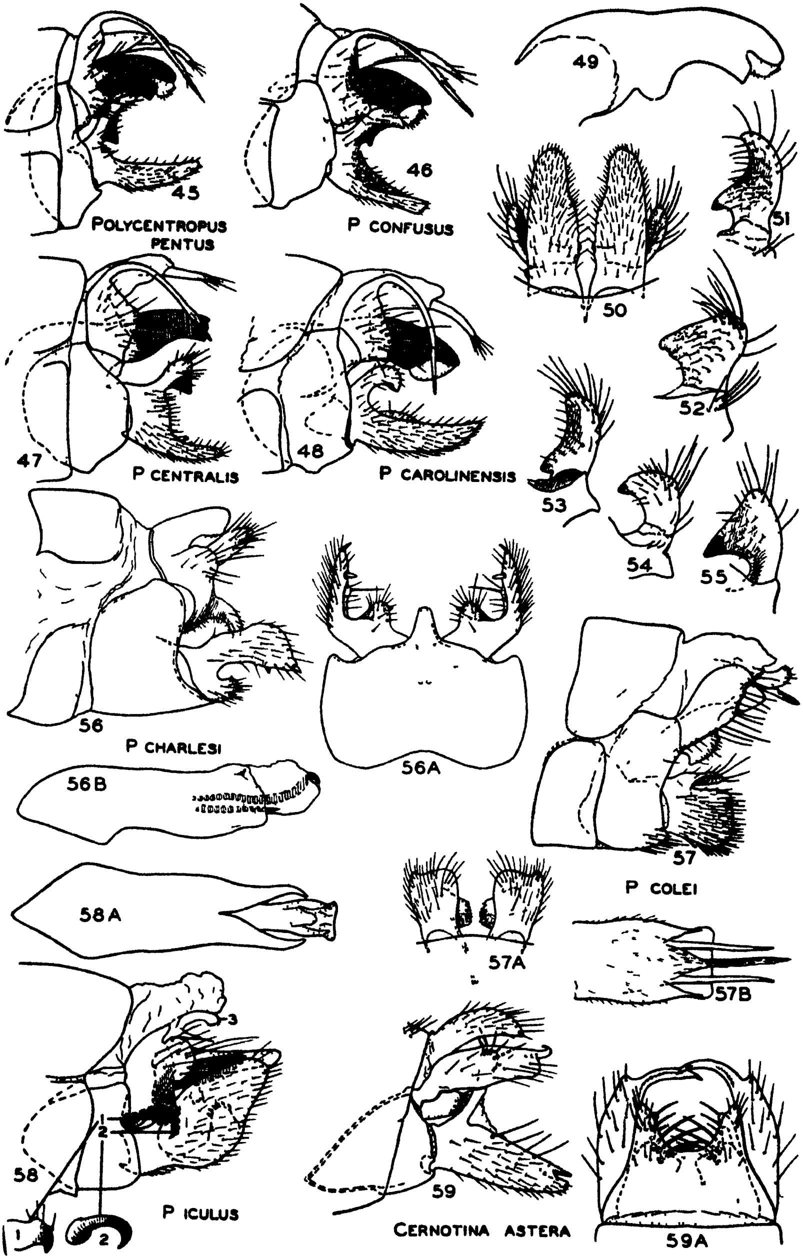

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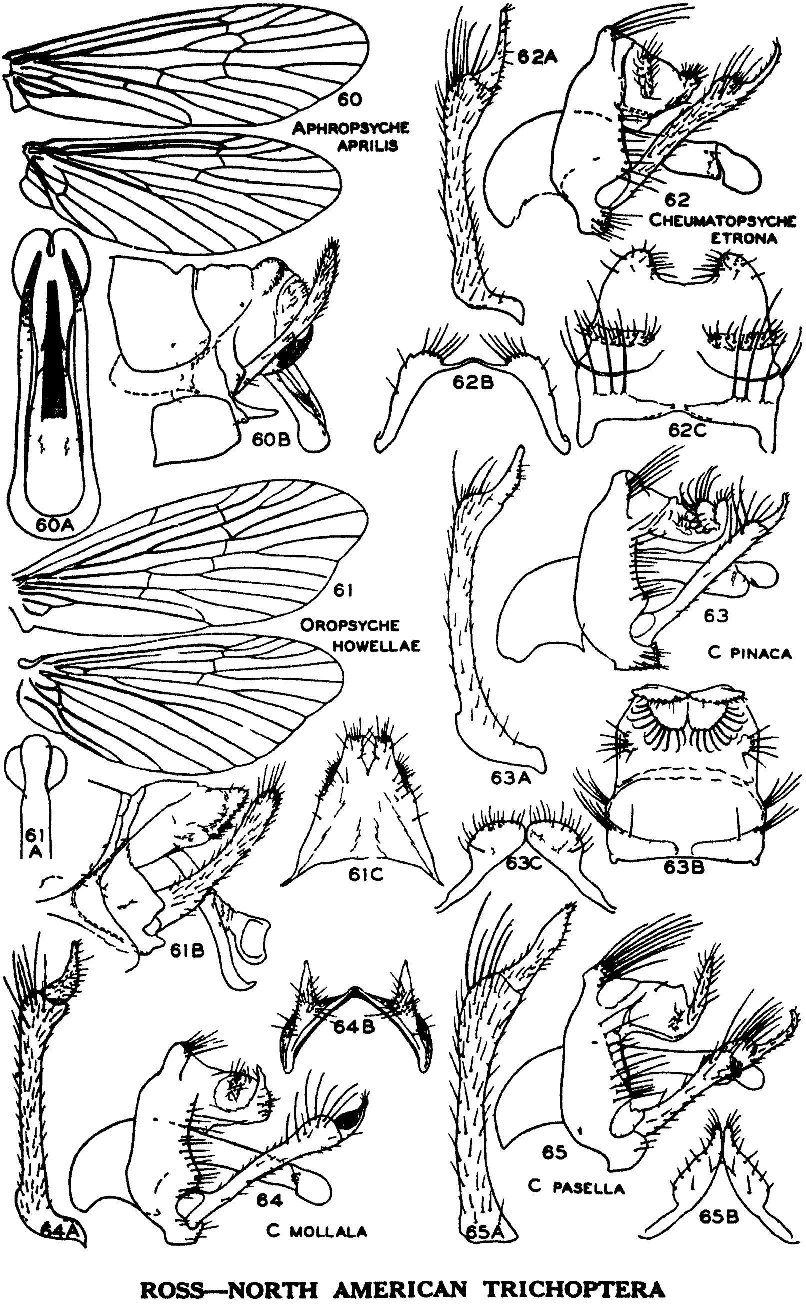

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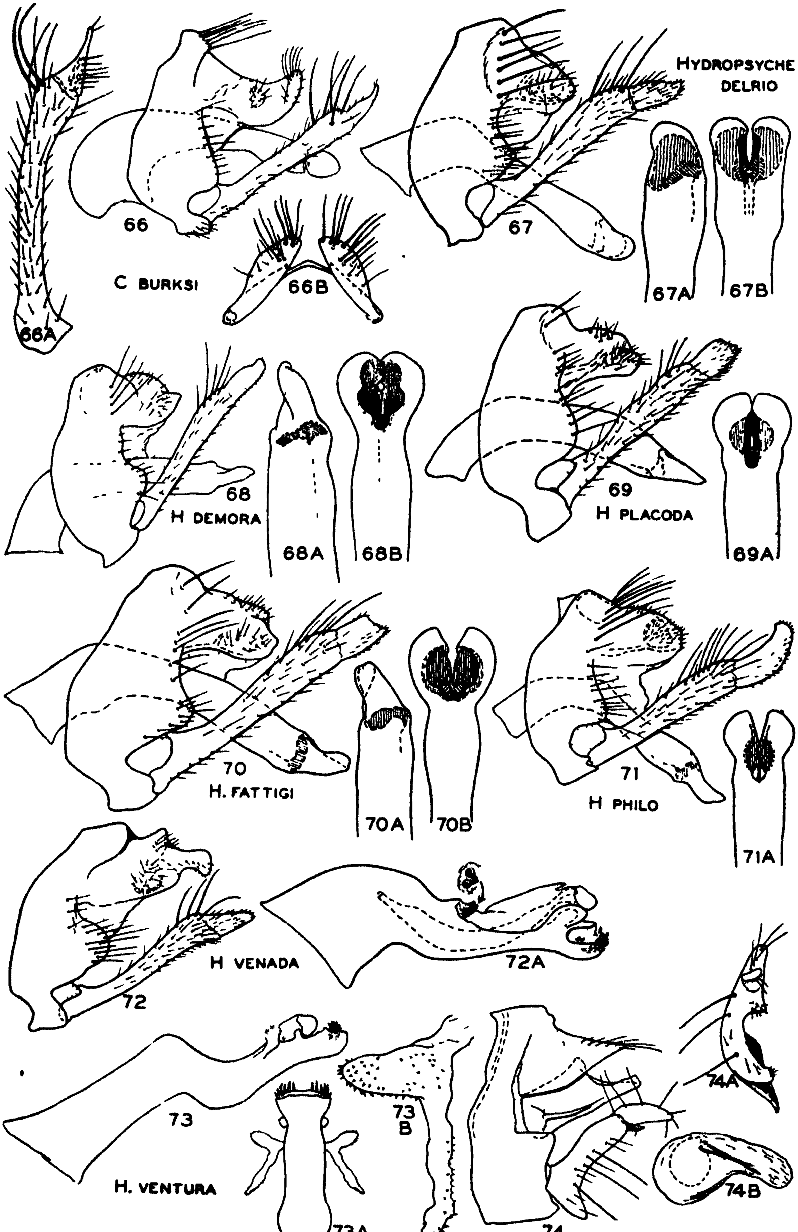

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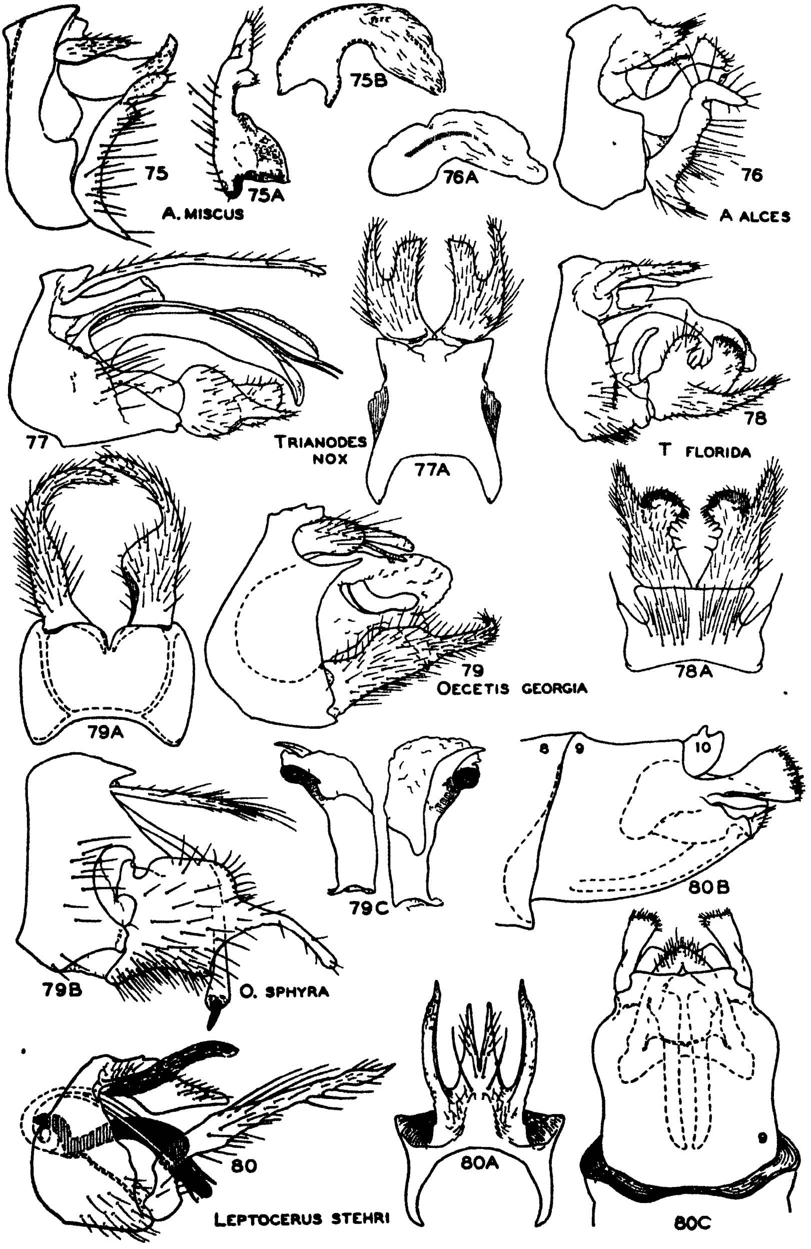
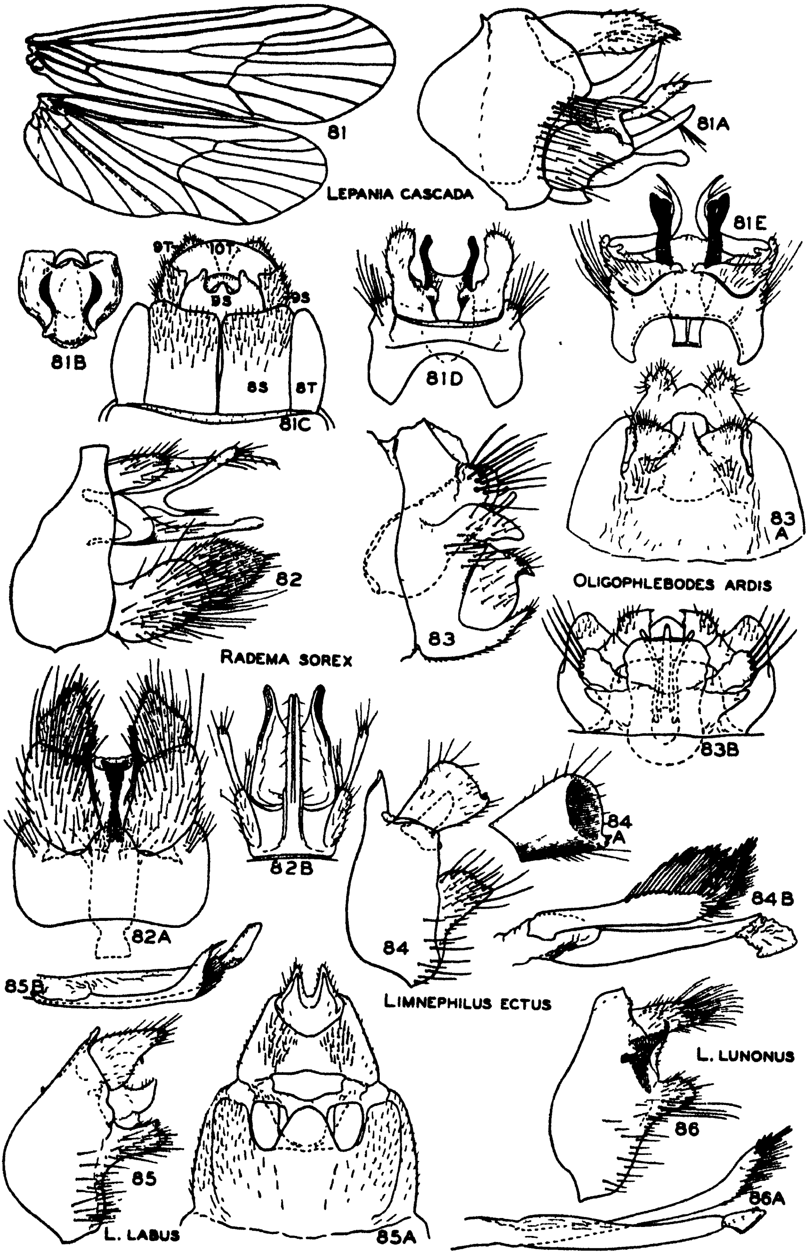


ROSS—NORTH AMERICAN TRICHOPTERA

Plate XI.



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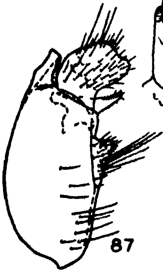
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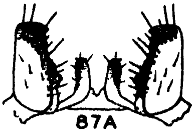
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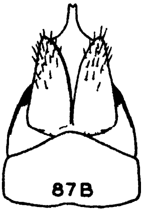
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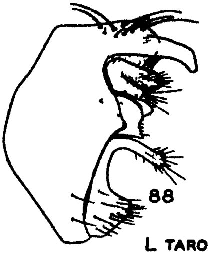
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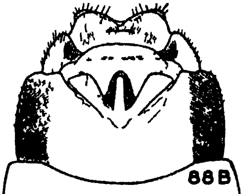
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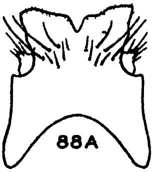
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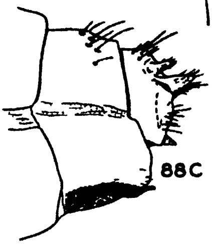
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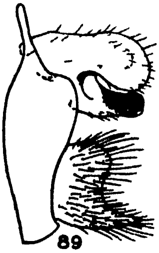
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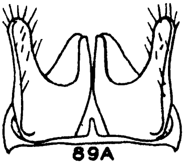
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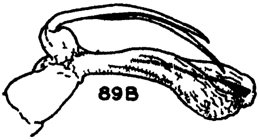
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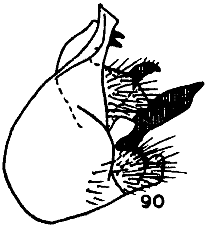
PHILOCASCA DEMITA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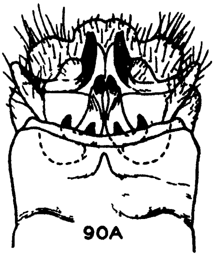
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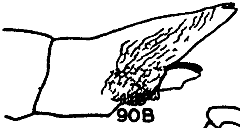
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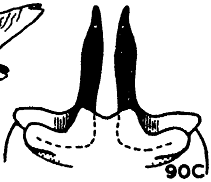
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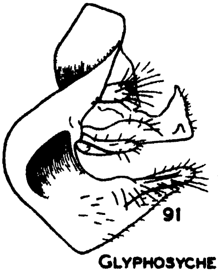
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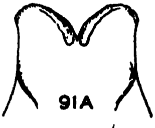
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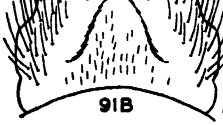
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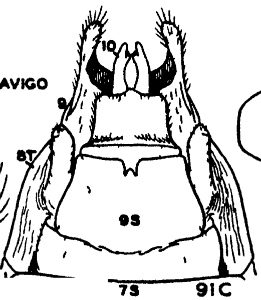

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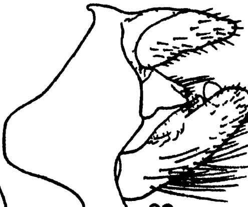
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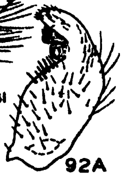
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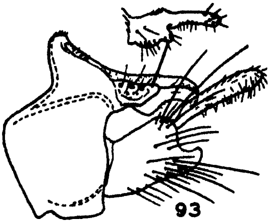
MICRASEMA SPRULESI

ROSS—NORTH AMERICAN TRICHOPTERA



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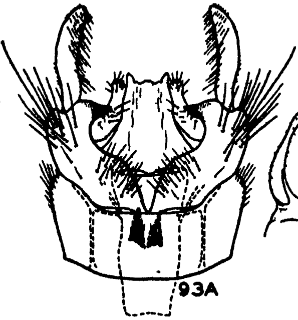

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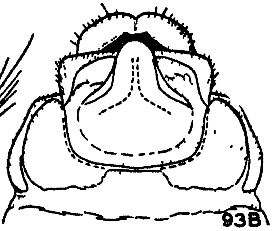

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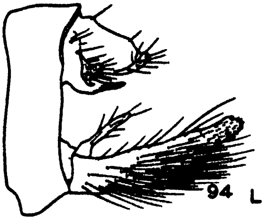

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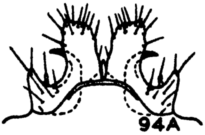

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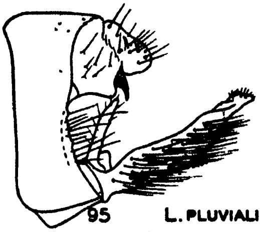

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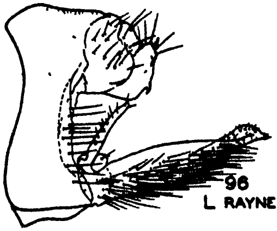

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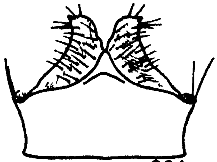

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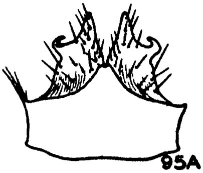

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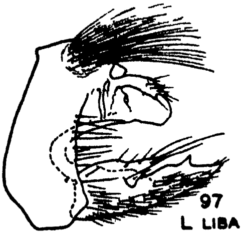

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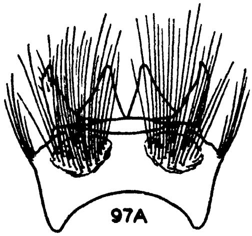

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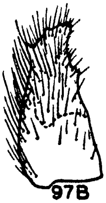

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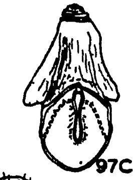

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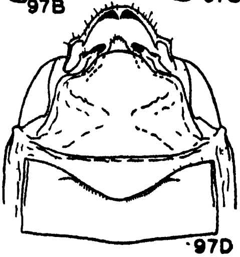

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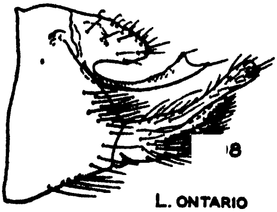
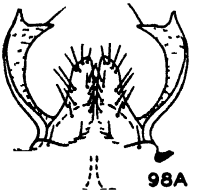


8

L. ONTARIO



98A

ROSS—NORTH AMERICAN TRICHOPTERA

STUDIES IN THE SCARABAEIDAE OF NORTH AMERICA
(COLEOPTERA)
PARTS I AND II

BY MARK ROBINSON
Sharon Hill, Pennsylvania

I. Review of the Nigricornis Group of Canthon

The rarity of these beetles is shown by the fact that with the five collections studied there were only eighty six specimens before the author during the preparation of this paper. I have collected most of my specimens of *bispinatus* in the autumn, usually on old, partly dried toadstools in the pine barrens of New Jersey. Only once have I seen a specimen rolling a ball and this particular ball was composed of deer excrement.

I wish to thank the following men and institutions for the loan of their entire series in this group: The Academy of Natural Sciences of Philadelphia through Mr. E. T. Cresson, Jr., The United States National Museum through Dr. E. A. Chapin, The American Museum of Natural History through Dr. R. E. Blackwelder, and Mr. R. C. Casselberry.

Upon examining the genitalia of the specimens from the above named collections I have found that four distinct species can be separated in the unique group with two spurs on the posterior tibiae. These may be separated by the following key:

Granules on pronotum reduced to shining spots; punctures quite dense *punctaticollis* Schaeffer
Granules on pronotum small; punctures rather sparse
  Granules on pronotum ovate............................*nigricornis* Say
  Granules on pronotum lanceolate..................*bispinatus* new species
Granules on pronotum larger, denser, ovate; punctures obsolete *granulifer* Schmidt

Issued June 30, 1941

Canthon punctaticollis Schaeffer (Text-figs. 1 and 2.)
1915. *Canthon punctaticollis* Schaeffer, Journ. N. Y. Ent. Soc., XXLLL, p. 50.
1928. *Canthon punctaticollis* Blatchley (not Schaeffer), Fla. Ent., XI, p. 61.

This species was originally described as a variety of *nigricornis,* subsequently Blatchley gave his opinion that it was a distinct species which it unquestionably is. Beside lacking any well formed granules on the head and pronotum another distinguishing feature is the first joint of the hind tarsi which is one and a half times as long as the second joint while the other species in this group have the first joint equal or nearly equal in length to the second joint. The male genitalia is quite distinct from the other species and seems to have little or no variation among a series of four males examined. Specimens examined include the male type and six other specimens, all are from Florida.

Canthon bispinatus new species (Text-figs. 3 and 4.)

The lanceolate shaped granules on the pronotum plus the locality and very distinctive male genitalia will distinguish this species from *nigricornis* Say, it's nearest ally.

Convex, orbicular; opaque, with most of the granules shining; black, with the tarsi, spurs and anterior tibiae dark reddish.

Head eleven-fourteenth as long as wide; eyes rather narrow above. Clypeus reflexed, quadridentate, impressed behind the two median teeth which are rather long, acute and at right angles to the plane of the head. The outer two teeth are shorter and blunter. The genae at the clypeogenal suture produced into an acute tooth. Clypeus scabrous; the rest of the head is very finely granulate with a scattering of larger granules intermixed with a few rather large punctures; these punctures sometimes bear a short brownish hair.

Pronotum twice as wide as long, very convex; anterior angles rectangular, sides nearly straight to median angles, which are rounded, thence converging to rounded hind angles. Base emarginate near the hind angles and nearly half way to middle is another shallower emargination. Surface is covered with fine granules intermixed with larger, elongate granules and hair bearing punctures. There is a scutellar impression which is shallow and marked medially with a fine longitudinal line. Thoracic tubercule below lateral margin small.

Elytra widest one fifth from humeral angle gradually converging from its widest part, strongly so posteriorly. Striae indistinctly marked, minutely granulate. Intervals flat, finely granulate with intermixed larger granules. Scutellar impression shallow and there is also a smaller impression at base of fourth and fifth intervals.

Pygidium shining and nearly smooth at apex, sculptured like elytra basally. On each side of the median line basally there is a shallow, longitudinal depression.

Anterior tibiae smooth in front; tridentate, crenate between teeth and above third tooth. Hind tibiae with two spurs.

Length, 6.4 to 8.4 mm.; breadth, 4.2 to 6.4 mm.

Male. Anterior tibial spur elongate, broadest at tip which is triangularly emarginate, the outer angle of which is longer than the inner.

Female. Anterior tibial spur long, curved outward, acute at tip.

Type.—♂; Warren Grove, Burlington County, New Jersey; September 21, 1935; (Mark Robinson); [author's collection].

Allotype.—♀; Warren Grove, Burlington County, New Jersey; August 21, 1937; (Mark Robinson); [author's collection].

Paratypes.—2 ♂, 4 ♀; With same data as type. 1 ♂; With same data as allotype. 1 ♂; Cecil, New Jersey, May 18, 1940, (Mark Robinson). 2 ♀; Cecil, New Jersey, May 18, 1940, (R. C. Casselberry). 1 ♀; Fries Mill, New Jersey, May 19, 1934, (Mark Robinson). 1 ♀; The Plains, New Jersey, September 7, 1935, (Mark Robinson). 3 ♂, 1 ♀; Ocean City, New Jersey, June 16, 1940, (R. C. Casselberry). 1 ♂, 7 ♀; Mount Misery, New Jersey, September 14, 1940, (Mark Robinson). 1 ♀; Mount Misery, New Jersey, June 6, 1938, (Mark Robinson). 1 ♀; Whitesbog, New Jersey, July 22, 1933, (R. J. Sim). 2 ♂; Pennsylvania, [Horn collection]. 1 ♀; Watch Hill, Rhode Island, July 2, 1909, (W. Robinson). 3 ♂; Penington Gap, Virginia, (Hubbard and Schwarz). 2 ♀; Southern Pines, North Carolina, April 13, 1915, (A. H. Manee). 1 ♀; Southern Pines, North Carolina, July 4, 1908, (A. H. Manee). 1 ♂; Beaufort, South Carolina, April 15. 1 ♀; South Carolina, (Chittenden). 1 ♂; Thomasville, Georgia, March 24, 1904. 1 ♂, 1 ♀; Pine Apple, Alabama, June 29, 1879, (C. V. Riley). 1 ♀; Mobile, Alabama, October 25, (H. Soltau). 1 ♂; DeFuniak Springs, Florida, May 24. 1 ♂; Enterprise, Florida, May 23, (Hubbard and Schwarz). 1 ♂; Florida.

Paratype specimens are in the following collections: The Academy of Natural Sciences of Philadelphia, The United States National Museum, The American Museum of Natural History, Mr. R. C. Casselberry, and the author's.

Canthon nigricornis Say (Text-figs. 5 and 6.)

1827. *Canthon nigricornis* Say, Journ. Acad. Nat. Sci. Phila., III, p. 207.

Say described this species from material collected on his first western trip and said he found it at, "Cape Gerardeau (Missouri) and intermediate country between that town and the Rocky Mountains also New Jersey." Cape Gerardeau is the only definite locality mentioned so I consider this to be the type locality. I have before me specimens from Texas, Arakansas, Kansas, Missouri, Nebraska, Wisconsin and Michigan.

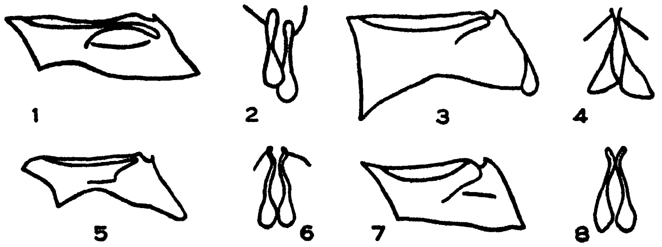
There seems to be quite a bit of variation in this species and at times it resembles *bispinatus* in pronotal sculpture but in this case the male genitalia and locality should be sufficient to make its recognition easy.

The New Jersey locality probably refers to *bispinatus*.

Canthon granulifer Schmidt (Text-figs. 7 and 8.)

1920. *Canthon granulifer* Schmidt, Archiv Naturgeschichte, Heft 9, p. 126.

The larger, denser granules and apparent lack of punctures on the pronotum is the distinguishing external feature between this species and *bispinatus*. Some specimens of *granulifer* approach the above named species to some extent even to having a few punctures on the pronotum. In this case the court of last resort is the male genitalia which seems to consistently differ from *bispinatus* as figured.



Explanation of text-figures. Fig. 1.—*Canthon punctaticollis* Schaeffer. Lateral view of left clasper. Fig. 2.—*Canthon punctaticollis* Schaeffer. Caudal view of claspers. Fig. 3.—*Canthon bispinatus* new species. Lateral view of left clasper. Fig. 4.—*Canthon bispinatus* new species. Caudal view of claspers. Fig. 5.—*Canthon nigricornis* Say. Lateral view of left clasper. Fig. 6.—*Canthon nigricornis* Say. Caudal view of claspers. Fig. 7.—*Canthon granulifcr* Schmidt. Lateral view of left clasper. Fig. 8.—*Canthon granulifer* Schmidt. Caudal view of claspers.

II. Seven New Species of Scarabaeidae

Copris cartwrighti[1] new species

Allied to *tullius* Oliv. and *inemarginatus* Blatch., from the former of these species it differs by not having the long horn on the head and the absence of thoracic protuberances on the male and from both species it differs in the stronger and denser punctures on the elytral intervals. *Copris inemarginatus* also lacks the clypeal emargination.

Oblong-oval; black; shining.

Clypeus triangularly emarginate, feebly sinuate on each side of the emargination, frontal edge reflexed. Vertex of head with a low, blunt tubercule. Head rather coarsely punctured, each of these pits are separated by about their own diameters.

Pronotum very convex; sides straight, sinuate in front to anterior angles which project outwards; posterior angles broadly rounded. There is a shallow pit just anterior to the hind angles. On the disk there is a vague groove medially. Surface coarsely punctured, dorsally these pits are separated from about their own radius to about their own diameter, confluent laterally. Parallel to the posterior marginal line is a row of large, oval punctures.

Elytral striae broad, shallow; strongly alutaceous, crenately punctured, edges between punctures margined with a raised line. First and eighth striae usually narrower than the others, eighth striae entire. The punctures on the convex intervals are not quite as large as on the pronotum and are separated by about one and one-half times their own diameter; alutaceous and impunctate along a narrow strip on each side of the striae.

Pygidium punctured about the same as thoracic disk. Metasternum and mesosternum coarsely and moderately punctured except medially where they are impunctate. Middle and posterior femura engraved with a few oblong punctures. Abdominal segments coarsely, densely punctured along their anterior edge except the terminal segment which also has a few smaller punctures scattered over it's surface laterally.

Anterior tibiae quadridentate; spur straight, stout, inturned at the tip.

Length, 12 to 17.5 mm.; breadth, 6.5 to 9.5 mm.

Male. Viewed from the side the abdomen is concave in outline.

Female. Viewed from the side the abdomen is straight in outline.

Type.—♂; Cashiers Valley Road, Oconee County, South Carolina; October 16, 1934; (O. L. Cartwright); [author's collection].

Allotype.—♀; with same data as type; [author's collection].

Paratypes.—13 ♂, 16 ♀; Cashiers Valley Road, Oconee County, South Carolina, various dates from October 3, 1934 to October 23,

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[1] I take great pleasure in naming this species after my good friend and fellow Scarabaeidist Mr. O. L. Cartwright.

1934, (O. L. Cartwright). 1 ♂; Sunburst, North Carolina, August 17, 1937, (O. L. Cartwright). 1 ♂, 1 ♀; Fish Hatchery, South Carolina, April 28, 1939, (O. L. Cartwright). 1 ♀; Jocassee, South Carolina, July 13, 1936, (O. L. Cartwright).

Paratypes are in the collections of Mr. O. L. Cartwright and the Author.

Bolbocerosoma quadricornum new species (Text-fig. 9.)

This species keys to *confusum* and *biplagiatum* in Brown's key to the species of *Bolbocerosoma.*[2] It differs from these species greatly by the shape of the male genitalia which approaches *hamatum* in the presence of a hook on the lateral lobes. The shape and place of the elytral spot and puncturation of the pronotum will distinguish it from *hamatum.*

Rotundate; reddish-brown except posterior margin of pronotum, scutellum, sutural stiae of elytra and round spot on each elytron, black. This spot is post median, starting at the fourth striae and continuing to the margin. Under side a lighter brown in color.

Head coarsely punctured, but little less so on the vertex. Pronotum with coarse and fine punctures on the disk, laterally the coarse punctures become smaller and much more dense.

Second elytral striae obsolete, fifth represented by two or three punctures, eighth striae is represented by a row of fine punctures; strial punctures without trace of hairs.

Mesosternal prominence acute, not quite as high as metasternal plane. Anterior tibiae with eight teeth, gradually diminishing in size from apex.

Male. Pronotal modification well developed; the carina broadly, deeply emarginate forming a tubercule on each side. In front of these tubercules is a sparsely punctured concavity; on each side of these concavities is a well developed tubercule.

Length, 8.8 mm.; breadth, 6.4 mm.

Type.—♂; New Braunfels, Comal County, Texas; August; (C. F. A. Schaeffer); [author's collection].

Rhombonalia adscita new species

This species has the small narrow ligula, with a narrowly arcuato-truncate apex and all other characters Casey used to separate *Rhombonalia* from *Anomala* but the larger claws on the four anterior tarsi are cleft thus bringing this genus closer to *Anomala.* The sculpturing of the elytra and the tarsal claws will separate this species from *camancha* Wickham to which it is most nearly related. I have preserved the name under which it and the following species was found in the Schaeffer collection.

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[2] Can. Ent., LXIX, p. 192, 1928.

Oblong, parallel; yellowish-testaceous with the head, tibiae and tarsi a little darker.

Clypeus rounded in front, angles broadly rounded, sides nearly parallel; edge strongly reflexed in front, gradually diminishing until it is even with the plane at the suture. The suture is a straight groove from side to side. Surface of clypeus moderately, densely punctured; vertex finely, sparsely punctured.

Thorax three-fifths as long as wide, very convex, widest just before the middle then arcuately converging anteriorly to the obtuse angles; posteriorly, nearly straight to posterior angles. On each side near the hind angles is a raised, convex, longitudinal line. Basal marginal line entire. Surface of pronotum rather sparsely punctured with large shallow punctures on the disk; these punctures are closer and smaller laterally, between these fovae the surface is microscopically alutaceous.

Surface of scutellum is the same as the sides of the pronotum. Striae of elytra well indicated; punctures not well defined. Intervals with irregular, transverse, groove like punctures; alutaceous.

Propygidium and pygidium sparsely punctured with large shallow punctures. Tarsi as usual in the genus with the exception that the larger claw on the anterior and middle tarsi is cleft, the upper ramus on all the claws is short and thin. Antennal club as long as entire stem.

Length, 12.8 mm.; breadth, 6.4 mm.

Type.—♂; Tuba City, Coconino County, Arizona; July 20, 1911; [author's collection].

Pachystethus floridana new species

This species is allied to *oblivia* Horn but the sculpturing of the pygidium is coarser, the color is different and the genitalia of *floridana* is not hooked at the upper part of the claspers nor are the claspers emarginate in the middle as they are in *oblivia*.

Body ovate, very convex; shining; piceous; head, thorax and tibiae with a greenish lustre; underside and femura dark reddish.

Front of clypeus straight, angles broadly rounded, sides parallel; edges moderately reflexed; surface scabrous; frons moderately punctured.

Pronotum convex, five-sixths as wide as elytra. Sides of pronotum nearly parallel in basal half, converging and straight in anterior half. Disk moderately coarsely and evenly punctured, surface between punctures alutaceous. Basal marginal line is barely indicated sublaterally.

Surface of scutellum alutaceous, punctures a little smaller than on the pronotum. Elytra a little inflated behind the middle. Striae moderately coarsely, crenately punctured. The second interval biseriately punctured, fourth and fifth uniseriately, the third interval more convex, without coarse punctures; all of the intervals have a few fine punctures scattered over their surfaces and are microscopically alutaceous.

Pygidium convex, with dense, strong, wavy sculpturing. Mesosternal protuberance narrow, rounded.

Male. Larger claw of anterior tarsi cleft, the upper ramus thinner but about equal in length to the lower.

Length, 10.2 mm.; breadth, 5.1 mm.

Type.—♂; Royal Palm Park, Dade County, Florida; March; (probably collected by W. S. Blatchely); [author's collection].

Trox (Omorgus) nigrescens new species (Text-fig. 11.)

The larger elytral tubercules with less space between the rows and the generally thinner male genitalia are the greatest differences between this species and *tesselatus* Leconte its nearest ally.

Elongate-oval; black; moderately shining.

Clypeus triangular, strongly reflexed. Head transversely bituberculate, there is a rather deep pit between each tubercule and the anterior clypeal edge; punctures coarse but not very dense.

Pronotal sides arcuate with just a bare trace of a notch before the hind angles. There is a ridge on each side of the median line in the anterior two-thirds, the posterior third of the median area is composed of a broad shallow depression which is flanked on the outside by a short, convex, longitudinal ridge. There is another flattened ridge, shorter, but parallel with the outside of each of the anterior median ones. Between these ridges and the posterior angle are two blunt tubercules, one in front of the other. Pronotal punctures a little coarser than on the head.

Elytral tubercules round to oval, convex, tomentose posteriorly, transversely confluent. Each row of elytral tubercules are nearly equal in size; between each row is a row of coarse punctures.

Anterior tibiae with a single tooth half way from apical bifid process to base. Anterior tibial spur straight, stout and acute in both sexes.

Wings: Length, 18 mm.; breadth, 7 mm.

Length, 14 mm. breadth, 8.5 mm.

Type.—♂; San Jose Del Cabo, Baja California, Mexico; (Beyer); [author's collection].

Allotype.—♀; with same data as type; [author's collection].

Paratypes.—2 ♂; with same data as type; [author's collection].

Trox (Omorgus) confluentus new species (Text-fig. 10.)

The elytral tubercules which are even more confluent and the male genitalia are the main characters which separate this species from *umbonatus* Lec. The median lobe of the male genitalia is longer and is not concave dorsally as is *umbonatus* Lec. also the dorsal surface of the claspers are gradually declining not abruptly as in Leconte's species.

Oblong; black; shining.

Clypeus and head the same as *nigrescens.*

Pronotal sides parallel converging in front, a slight notch just before the hind angles which are obliquely sinuate. Base straight not produced medially. Anterior median tubercules complanate, concurrent, the inner angle produced posteriorly; other tubercules as usual in this subgenus. Punctures coarse but sparse on the tubercules, coarser and denser between the tubercules.

Elytral sides parallel; humeral umbone obsolete. Tubercules so confluent longitudinally and transversely that at times the only break in a smooth surface is the single row of punctures between the alternating rows. Spaces between tubercules and sides of punctures tomentose.

Anterior tibial spur long, acute, down curved at tip in the male; shorter, stouter and straight in the female.

Wings: Length, 8.15 mm.; breadth, 4.5 mm.

Length, 17.0 mm.; breadth, 9.0 mm.

Type.—♂; La Sal Mountains, San Juan County, Utah; (D. E. Hardy); [author's collection].

Allotype.—♀; with same data as type; [author's collection].

Paratype.—♂; with same data as type; [author's collection].

Trox (Omorgus) tomentosus new species (Text-fig. 12.)

The summits of the elytral tubercules being tomentose and the male genitalia will distinguish this species from *integer* Lec. its nearest ally.

Oblong-oval; brownish-black; not very shining.

Head the same as *nigrescens.*

Pronotal sides arcuate with a well developed notch just before the hind angles. The thoracic tubercules and ridges as usual in this group except they are a little better developed than in most species. Punctures rather large but coarse and nowhere dense.

The four primary rows of elytral tubercules well developed, the inner row longitudinally confluent, carina-form; the summits of these tubercules are covered with tomentose interspersed with short, brownish squamiform setae. The five secondary rows of tubercules are obsolete each being replaced by a row of small round patches of squamiform setae. Between each of these rows and the primary rows is a row of coarse punctures; just anterior to each puncture is a small, round patch of scale like setae. Humeral and apical umbones well developed and covered the same as the large tubercules.

The tooth on the outside margin of the anterior tibiae barely indicated; anterior face of tibiae coarsely, densely punctured. Anterior tibial spur short, elongate-triangular, acute at tip; a little thicker basally in the male.

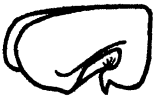
Wings: Length, 15 mm.; breadth, 6 mm.

Length, 13 mm.; breadth, 7 mm.

Type.—♂; Nayarit, Mexico, 1936; (A. Maas); [author's collection].

Allotype.—♀; with same data as type; [author's collection].

Paratype.—♂; with same data as type; [author's collection].



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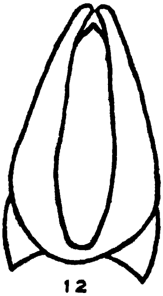

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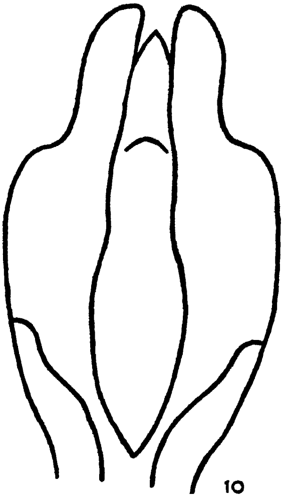

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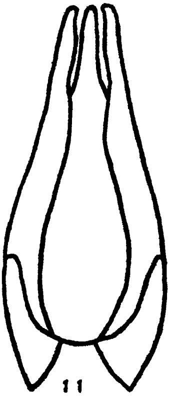

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Explanation of text-figures. Fig. 9.—*Bolbocerosoma quadricornum* new species. Lateral view of right genitalic capsule. Fig. 10.—*Trox confluentus* new species. Dorsal view of genitalia. Fig. 11.—*Trox nigrescens* new species. Dorsal view of genitalia. Fig. 12.—*Trox tomentosus* new species. Dorsal view of genitalia.

ON NEW AND PREVIOUSLY-KNOWN SPECIES OF PNEUMORIDAE (ORTHOPTERA; ACRIDOIDEA)

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(Text-figures)

The strange and structurally remarkable members of the Pneumoridae are but little known, as the literature relating to them is very limited, and they are represented in but a restricted number of institutional collections, while in addition their systematics have long been in a rather chaotic condition. The generally papery structure, inflated abdomens, semi-membranous and generalized alar organs and apparently poor saltatorial ability of these insects contradict most ideas as to locust or grasshopper characteristics. They have usually been considered to represent a subfamily of the Acrididae, but most definitely they constitute a group, probably ancient, fully worthy of family rank, certainly equalling the grouse-locusts (Tetrigidae) in this respect.

Their distribution is limited to southern and eastern Africa, the ranges of all the forms but one (viz *Shortridgea absidata*) being limited on the north by the Zambesi, the one exception occurring in an apparently limited area in Tanganyika. Their greatest development is in the Cape Province, and none has been reported from Angola, the Kalahari or Southwest Africa, and the first Transvaal record is here presented.

The systematics rest basically on Stål's 1873 studies of the types of Linnaeus' and Thunberg's species, with his additions to the previously-known forms. The original descriptions of these older forms are of very limited service in the recognition of these species. In 1916 Péringuey added certain species and his own interpretations of most of the older ones, but in some respects he muddied rather than clarified the situation.

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The lack of definite information in past literature on the occurrence of the species is most unusual, but probably has been due to the secretive habits and rather infrequent captures of these insects. In certain cases the present records are the first exact ones in published literature of species known taxonomically for more than a hundred years. Again in certain instances the measurements of respective parts of the insects here presented are the first published, the previous ones having been merely of general length. Beyond question our knowledge of these interesting insects will augment considerably in the next few decades, but it seemed most desirable to place on record the present set of observations, if only to interest other students in the subject.

The material on which these notes and descriptions have been based is from the collection of the Academy of Natural Sciences of Philadelphia, from the Hebard Collection there located, the collection of the Museum of Comparative Zoology, that of the Transvaal Museum of Pretoria, and the private series of Dr. W. J. Van der Linde, of the University of Pretoria. To the authorities of these institutions, and to Dr. Van der Linde I am under obligations for the opportunity to study this material. To Dr. C. A. du Toit, of Stellenbosch, Cape Province, I am particularly indebted for the opportunity to examine material of three species sent by him to the Zoological Department of the University of Pennsylvania for cytological studies. After the removal of the gonads the specimens were placed in the Academy collection, thanks to the courtesy and cooperation of Dr. E. R. Helwig, of the University of Pennsylvania.

BULLACRIS Roberts

1758. *Gryllus* (*Bulla*) Linnaeus, Syst. Nat., X ed., I, p. 427. (In part, and of most subsequent authors, but not as limited by first designation of type of genus by Kirby in 1890.)

1941. *Bullacris* Roberts, Trans. Amer. Entom. Soc., LXVII, p. 18. Genotype by original designation, *Gryllus* (*Bulla*) *unicolor* Linnaeus.

The earliest designations of types for the three older generic names used in the Pneumoridae have recently been carefully traced out by Roberts,[1] and no additional discussion of these matters is necessary. Unfortunately the first proposed name (*Bulla*) must be shifted to the generic concept long known as *Pneumora,* and the latter name to that for which *Cystocoelia* has been current. There is no alternative course unless the earliest type designations are to be disregarded, and no warrant exists for such action. The generic name *Bulla* of Linnaeus I am continuing to use for the entity to which Roberts shows it was first restricted by type designation.

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[1] Trans. Amer. Entom. Soc., LXVII, pp. 1–34, (1941).

As a believer in unrestricted and complete priority—date, page and line—I regard *Bulla* of Linnaeus, 1758, as a valid generic name in the Orthoptera, the Linnean divisions of *Gryllus* (of which it is one) being even more definite and exact than many subsequently proposed and currently used subgenera of other authors, even in the nineteenth century. The orthopteran *Bulla* has page priority over the use of the same name generically for mollusks by Linnaeus. The fact that Linnaeus maintained no restricted subgenus *Gryllus,* as has been argued against the retention of the Linnean subgenera of *Gryllus,* is quite aside from the point, as almost no authors of the eighteenth century did so, and this is also true of many investigators of the earlier decades of the nineteenth century, all of whose subgeneric entities have been allowed to stand or fall on their individual merits, without discussion of this angle.

Bullacris immaculata (Thunberg) (Text-figs. 1–3.)

"1775. *Pneumora immaculata* Thunberg, Vet-Acad. Handl., XXXVI, p. 256, pl. 7, fig. 1." [2] [South Africa.]

CAPE PROVINCE: Stellenbosch; November, 1940; (C. A. du Toit); 2 ♂; [A. N. S. P.]. "Cape"; (Schaum's Collection); 1 ♂; [M. C. Z.].

The small head and the relatively pilose vesture of the same, the cephalic portion of the pronotum, pleura and pectus are distinctive features of the male of this species and the two related ones here described.

One of the Stellenbosch males has much of the pronotum, the head and limbs, as well as areas on the sides of the abdomen, washed with salmon pink. The other male has these areas of the general green tone, the pronotal crest line approaching orange.

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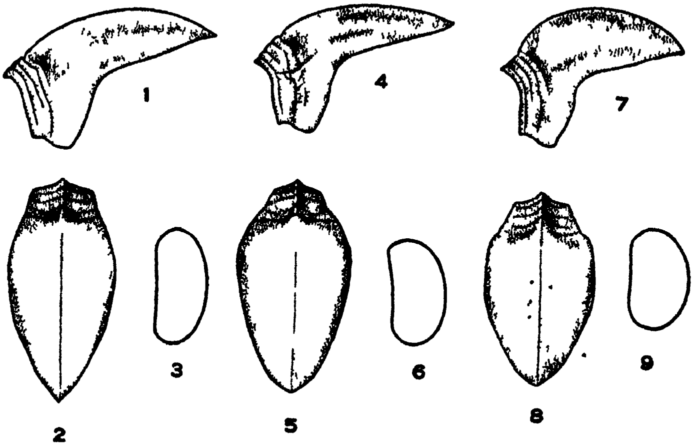
[2] I am unable to verify this reference, as the earlier volumes of the Swedish Academy of Science's Handlingar are not present in Philadelphia, although the numerous volumes of the other series of its issues are in the Academy's library.

When closed the male tegmina are gray green in the male with the body areas green, and but little dark punctate; in the male with the pronotum washed with salmon pink they are lighter and more greenish, with more numerous and more regularly scattered fuscous puncta. Both Stellenbosch males have the dorsal exposed half of the metathoracic episterna dull lead gray. The lateral abdominal ocelliform spots are slightly larger but less sharply defined in the orange washed specimens than in the other. The " Cape " specimen has been dried from alcoholic preservative and is completely decolored.

No exact information on the distribution of this species in available, other than Péringuey's statement that it "occurs in the Cape Peninsula, and in the neighbouring districts of Stellenbosch and the Paarl." The two new species here described probably are complementary to *immaculata* in their respective areas.



Bullacris immaculata (Thunberg). Male. Stellenbosch, Cape Province. Fig. 1. Lateral view of pronotum (× 1½). Fig. 2. Dorsal view of pronotum (× 1½). Fig. 3. Outline of eye (enlarged). ***Bullacris thalassina*** new species. Male (*type*). Willowmore, Cape Province. Fig. 4. Lateral view of pronotum (× 1½). Fig. 5. Dorsal view of pronotum (× 1½). Fig. 6. Outline of eye (enlarged). ***Bullacris namaquensis*** new species. Male (*type*). Springbok, Namaqualand, Cape Province. Fig. 7. Lateral view of pronotum (× 1½). Fig. 8. Dorsal view of pronotum (× 1½). Fig. 9. Outline of eye (enlarged).

Bullacris thalassina[8] new species (Text-figs. 4–6.)

Closely related to *B. immaculata* but separable by the rather differently proportioned head, with its lower transverse arcuation of the interocular outline as seen in cephalic aspect, broader and shorter basal outline of the eye as seen in lateral aspect, the broader and shorter pronotum as seen from the dorsum, the more welt-like indication of the humeral angles of the pronotum cephalad of the broadest point of the pronotum, the less compressed and more definitely and broadly tectate pronotal crest, the more rounded and subobtuse caudal angle of the pronotal disk and the closely and cribrosely areolato-punctate surface of the dorsum of the metazona, as well as the rather closely subtuberculate character of the prozonal surface.

The relationship of this species to *B. namaquensis,* described beyond, is closer than to *B. immaculata,* the agreement of *thalassina* and *namaquensis* in the general shape of the head and eyes, and the proportions of the pronotum as seen in dorsal aspect being marked, although very definite features of difference are evident and have been given in the diagnosis of *B. namaquensis.*

It is evident that *immaculata, thalassina* and *namaquensis* form a natural group of the genus, characterized by the relatively small head and definitely pilose condition of much of the surface of the cephalic portion of the body. Each of the three forms may be limited to a different area of the Cape Province, but the available information is too meager to do more than suggest this may be the case.

Type.—♂; Willowmore, Willowmore District, Cape Province, Union of South Africa. November 5, 1909. (Dr. Brauns.) [Transvaal Museum.]

Size and general form much as in *B. immaculata;* sculpture of head and pronotum somewhat more accentuated, of head, and particularly face, more densely tuberculate, of pronotum well etched cribroso-reticulose, vesture of head, pronotum, pleura and pectus as in *immaculata.*

Head as strongly withdrawn into the pronotum as in *B. immaculata* as seen in cephalic aspect with its ratio of genal breadth to depth as 31 to 43, much as in *immaculata* (31 to 45) but the supra-ocellar portion of the head is definitely lower, more strongly transverse and with the interocular outline of the head (transversely) definitely lower and less strongly arcuate, the transverse interspace between the eyes being contained slightly more than twice in that across eyes (as 14 to 31), while in *immaculata* this interspace is broader, contained 1.8 times in the width across eyes (as 17 to 31); ocelli placed as in *immaculata,* of similar relative size except that the median (ventral) is slightly smaller; eyes in cephalic aspect as in *immaculata,* in profile their basal outline is less elongate and broader reniform instead of elliptico-reniform, the greatest median width of outline to greatest depth as 20 to 42, as against 20 to 46 in *immaculata;* sculpture of head more densely tuberculato-rugulose than in *immaculata.* Antennae relatively short (one incomplete), when extended ventrad surpassing lower border of buccal region by no more than the depth of facial scutellum.

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[8] In allusion to the blue-green color of the metazonal dorsum in the type.

Pronotum as a whole lower, shorter and broader than in *immaculata,* as seen from the dorsum with the greatest width across the humeral angles contained 1.8 in length as against twice in *immaculata;* cephalic margin of disk in dorsal aspect subrectangulate produced mesad, and not slightly acute with subconcave sides of the production as in *immaculata,* caudal margin of disk broad, semi-elliptically rounded, in no sense acute produced as in *immaculata;* seen in profile the arcuation of the metazonal crest is somewhat lower than in *immaculata,* the curvature of the prozonal portion of the median crest is as evenly continuous with that of the metazona as in *immaculata,* although it is slightly longer proportionately than in that species, principal sulcus at point of severance of the median carina less acute than in *immaculata* as seen from the dorsum, even slightly broader than a right angle: prozona with its three transverse sulci all definitely but not deeply severing the median carina, their degree of indication and extent ventrad as in *immaculata;* surface of prozona, and particularly dorsad, closely ruguloso-tuberculate; humeral shoulders indicated across prozona from first transverse sulcus as low cicatriform carinulae definitely reaching to slightly caudad of the widest point of disk and thence traceable as a leaf-like vein unevenly approaching the median carina, which is met briefly before the apex of the disk; in transverse section the pronotum at broadest point is markedly lower than in *immaculata* and with the tectation limited to the vicinity of the median keel, surface of the metazona as a whole very definitely and yet closely cribroso-reticulose, of the prozona tessellately low-tuberculate: lateral lobes of pronotum having essentially the same proportions as in *immaculata,* the caudal margin strongly oblique and the ventral one very definitely sigmoid, ventro-cephalic point sharply rectangulate, ventro-caudal angle rounded obtuse.

Tegmina when closed reaching as far caudad as the apex of the abdomen, of the membranous type characteristic of the genus, apex slightly blunter and with the costal margin more arcuate distad than in *immaculata;* principal and more evident secondary venation as in *immaculata.* Wings reaching to the tegminal apices when closed.

Meso-metasternal shield projecting cephalad beneath a considerable part of the prosternum, masking approximately one-half of the latter when seen in ventral aspect; cephalic margin of mesosternal portion rounded obtuse-angulate as seen from venter, mesosternal lobes with the median deeply foraminal interspace transverse, in width hardly one-third the same dimension of one of the lobes, the internal and caudal margins of the latter broadly arcuate, cephalad of the interspace a pair of diverging sulci extend to the latero-cephalic portions of the mesosternum; metasternum broader than the mesosternum, metasternal foraminal interspace slightly narrower than the mesosternal one, strongly transverse, metasternal lobes not clearly set off from the proximal abdominal sternite. Pleura well inflated, moderately protuberant laterad.

Abdomen of the inflated bladder-like type characteristic of this and related genera; apex of abdomen in its external details as in *immaculata,* except that the lateral portions of the penultimate tergite[4] have the ventral margin more oblique than in *immaculata,* and the disto-ventral angle of the same is sharply obtuse-angulate instead of rounded rectangulate; apex of ultimate sternite (subgenital plate), as seen in profile, less sharply acute than in *immaculata.*

Limbs essentially as in *B. immaculata,* the cephalic and median ones equally slender, the cephalic femora in length shorter than the greatest dorsal width of the pronotum (equal to five-sixths), instead of subequal to same as in *immaculata,* this being due to the definitely broader pronotum of *thalassina,* cephalic femora like those of *immaculata* without indications of proximal tubercles; caudal femora in length subequal to greatest depth of pronotum—crest to ventral point of lateral lobes.

Coloration.—Dorsum of metazona of pronotum light Paris green, laterad in the post-humeral section darkening to verdegris green, mesad in the vicinity of the median crest paling to light dull green-yellow: light base color of the prozonal portion straw yellow (faded from greenish?), the median crest there and the welt-like lateral shoulders clear straw yellow, cloudings of mummy brown sharply bordering the pale lateral shoulders dorsad and the median crest caudad, the low prozonal tubercles all pale, both within and outside of the mummy brown areas, the pale welt-like lateral shoulders broad and conspicuous from the first transverse sulcus to the principal one, thence caudad narrowing and becoming obsolete, at the point of greatest width touched by a mummy brown cloud, ventro-caudad of which a fine line of pale Veronese green extends to the adjacent post-humeral margin of the pronotum. Head cinnamon-buff, darkening to tawny-olive dorsad, buccal area faintly greenish; ocelli light hazel; eyes ochraceous-tawny with a vertical narrow line of mummy brown; antennae cinnamon-buff. Tegmina glass green, darkening to pale absinthe green in certain areas, as near the humeral trunk, the palest portion being in the anal area; numerous small circular dots of weak mummy brown are widely scattered over the tegmina, these not entirely balanced on the two tegmina. Pleura of the general color except that the mesopleural episternum is washed with cinnamon-brown cephalad, and the metapleural episternum has its dorsal five-sixths largely cinnamon-brown (pale dorsad), ventrad enclosing a subrhomboidal and sharply contrasted area of pinkish buff. Abdomen with inflated portion light turtle green (Ridgway), bearing on each side three large, irregularly subelliptical and longitudinally disposed colonial buff maculations, the cephalic of each of which is surrounded by a vertically disposed cloud of cinnamon-brown, which latter, progressively caudad, show on other parts of their surface a number of small elliptical dots of the base color, briefly cephalad of the distal margin of each inflated tergite is placed a series of small colonial buff dots, spaced out and paralleling the margin, the teeth of the lateral stridulating file similarly colored; apex of abdomen ochraceous-buff (perhaps decolored); venter of abdomen antimony yellow, becoming rufous distad, broad medio-longitudinal area on thoracic sterna cinnamon-brown, becoming a series of median detached dashes of the same, one to a sternite, distad on the abdomen, the more distal appreciably divided into two longitudinally by a narrow straw yellow bar. Limbs ochraceous-buff to yellow ocher, femoral apices weakly and rather vaguely washed with very pale gray.

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[4] This is on the assumption that the supra-anal plate is a single (ultimate) tergite. If the supra-anal plate is made up of two fused tergites this would be the antepenultimate one.

Length of body, 38.7 mm.; length of pronotum, 18; greatest depth of pronotum in profile, 10.6; length of tegmen, 31.8; length of caudal femur, 11.4.

The type of this quite distinctive species is unique.

Bullacris namaquensis[5] new species (Text-figs. 7–9.)

Closely related to *B. immaculata,* described above, but differing in the even broader and shorter eye as seen in profile, the more strongly elevated, arcuate and more compressed crest of the pronotal metazona, which is also more definitely separated from the shorter prozona of the same, the less cribroso-punctate surface of the metazonal dorsum, which, however, has numerous regularly disposed, low but distinct tubercles scattered over its surface, and in the somewhat shorter cephalic and median femora. From *immaculata* the present form differs in much the same respects as does *B. thalassina,* although the dorsum of the metazona is much nearer that of *immaculata* in texture than it is to what is seen in *thalassina,* with the exception of the scattered tubercles characteristic of *namaquensis.*

Type.—♂; Springbok, Namaqualand, Cape Province, Union of South Africa. September, 1890. [Transvaal Museum.]

In a large number of its features the present species is in full agreement with *B. thalassina,* described above, and it is to be understood that where characters are not specifically here described the analyses given under *B. thalassina* apply with equal force to *B. namaquensis*.

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[5] After the land of the Namaqua people, whence came the type.

Size as in the related species; general form much as in *immaculata*, pronotal crest similar to that of same in elevation but outline of dorsum of pronotum much as in *thalassina* and not as in *immaculata;* surface of pronotum not definitely cribroso-reticulate (as in *thalassina*) but slightly rougher than in *immaculata*, with numerous small and low but definite and sharp shining spiculate nodes on the metazonal surface; vesture of head, pronotum, pleura and pectus as in the two relatives.

Head with ratio of genal width to head depth as 30 to 45, supra-ocellar portion of head as in *immaculata*, higher and more arcuate transversely than in *thalassina*, slightly narrower between juxta-ocular low tubercles than in *immaculata* (as 15 to 30 in genal width, as against 17 to 31 in *immaculata*), transverse interspace between eyes to width across eyes as 14 to 30; ocelli with their basal triangle more equilateral and less depressed and transverse than in the two related species, the three equal in size, the lateral ones not larger than the median (ventral), as in *thalassina;* eyes in cephalic aspect as in relatives, in profile with basal outline broad reniform and with the greatest median width to greatest depth as 25 to 39. Antennae incomplete.

Pronotum in profile much resembling that of *B. immaculata*, but its dorsum is shorter and broader, and its caudal extremity less produced, as seen from dorsum the greatest width across the humeral angles is contained 1.92 in length, in this respect virtually intermediate between the proportions seen in *B. immaculata* and *thalassina;* cephalic margin of disk as seen from dorsum subrectangulate produced mesad, caudal margin of disk relatively broad, roughly semi-elliptical in shape and much as in *thalassina*, but with its converging lateral portions a shade more straight oblique and less subarcuate; seen in profile the arcuation of the metazonal crest is slightly higher and more strongly arcuate than in *immaculata*, the prozonal portion of the same is much as in *immaculata* but less evenly continuing the more caudal arcuation, and the axis of the prozonal crest is directed more cephalad and less ventro-cephalad, thus making a definite obtuse-angle at principal transverse sulcus (as seen in profile), length of prozonal portion of crest proportionately as in *immaculata* and shorter than in *thalassina;* prozona with its three transverse sulci much as in *immaculata*, their intersection of the median crest less evident than in the other species, the entire prozonal portion of the crest finely wrinkled, so that the intersections are not distinctly evident but are there lost in the accessory pleating of the immediate crest, principal sulcus as seen from dorsum forming as acute an angle as in *immaculata;* surface of prozona hardly at all more rugulose than in *immaculata*, much less so than in *thalassina;* humeral shoulders on prozona less evident than in *thalassina*, on metazona essentially as in latter species, having the same disposition and emphasis; in transverse section the pronotum has its degree of tectation and curvature of the sides of the disk as in *immacu-*

lata, surface of metazona with the low nodulose points numerous and well scattered, many placed on tracheate or vein-like lateral ramifications of the slender, more distal part of the humeral ridges; lateral lobes of the pronotum as in related forms, surface sculpture more resembling that of *immaculata* than of *thalassina*.

Tegmina when closed reaching to the apex of the abdomen, as in related species, apices damaged, venation as in relatives. Wings apparently reaching to tegminal apices when undamaged.

Meso-metasternal shield with its cephalic margin subrectangulately produced ventrad of the prosternum, instead of rounded obtuse-angulate as in *thalassina*, the width between the median coxae slightly less than in the latter species, while that between the caudal coxae is essentially as in *thalassina*. Apex of abdomen as in *B. thalassina* except that the disto-ventral angle of the penultimate tergite is sharply rectangulate.

Limbs slightly shorter proportionately than in either *B. immaculata* or *thalassina*, the cephalic femora in length equal to but little more than three-fourths the greatest dorsal width of the pronotum; caudal femora equal to but seven-eighths the greatest depth of pronotum—crest to ventral point of lateral lobes.

Coloration.—Head, pronotum and tegmina between chamois and deep colonial buff (Ridgway)—possibly faded from a greenish tone—, pleura and abdomen light dull green-yellow, the buccal region of the head, the sterna and the venter of the abdomen washed with tawny to russet. Eyes cinnamon-brown, finely speckled with ochraceous-buff; vicinity of the ocelli washed with Prout's brown, the ocelli themselves antique brown, incompletely ringed with blackish. Pronotum with median crest dull zinc orange cephalad, clouding with cinnamon-brown caudad, many of the scattered surface nodulose points ochraceous-tawny. Tegmina without evident brownish dotting of any character, vicinity of the humeral trunk distad slightly brownish, probably by drying discoloration. Pleura with dorsal half of metathoracic episternum washed with bister, cephalic margin of dorsal section of metathoracic epimeron touched with light ochraceous-buff, elsewhere the pleura are of the general color given above. Three lateral maculae present on the inflated abdomen as in *B. thalassina*, but the areas, both light and dark, are smaller and definitely of less extent longitudinally (pale maculae) and vertically (dark maculae), colors the same as in *thalassina*, same pale dotting less numerous. Limbs cinnamon-buff to clay color. Venter of abdomen with middle bearing three longitudinal, parallel and very closely placed, finely pencilled lines of cinnamon-buff, distad less clearly traceable than proximad due to drying of internal tissues.

Length of body, 37 mm.; length of pronotum, 16.5; greatest depth of pronotum in profile, 13.3; length of tegmen, 32 +[6]; length of caudal femur, 10.7.

The unique type of this species is all I have seen.

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[6] Immediate apex damaged.

Bullacris discolor (Thunberg)

1810. *Pn[eumora] discolor* Thunberg, Kongl. Vetensk. Acad. Handlingar, XXXI, p. 59, pl. II, fig. 2. [♂; South Africa.]

CAPE PROVINCE: Stellenbosch; November 2, 1916; (Dr. H. Brauns); 1 ♂; [Transv. Mus.]. "Cape of Good Hope"; 1 ♂; [M.C.Z.].

The latter specimen has lost all colorational features and apparently was dried from a liquid preservative. However both individuals appear fully referable to *discolor*, regarding which previous literature is to an extent contradictory. As Stål * had before him Thunberg's original material, not only of this species but of Thunberg's *Pneumora pupillata* as well, which he considered to equal *discolor*, I have based my understanding of *discolor* on Stål's 1873 description.

The Stellenbosch individual approaches the phase of the species to which, according to Stål, Thunberg's name *Pneumora rubens* was in part applied. This specimen is almost entirely washed with buff-pink to onion-skin pink, the tegmina quite clearly of the latter shade and without fuscous dots,[7] while the pronotum approaches pale zinc orange. A double series of longitudinally disposed small lateral abdominal ocelliform spots of cream white, weakly relieved by narrow ferruginous encirclings, are present in the Stellenbosch male, while its face is almost solidly clear zinc orange. The disposition of the abdominal maculae in this specimen is much as in Thunberg's figure of the synonymous *pupillata*.[8] The caudal margin of the lateral lobes of the pronotum at and below the usual position of the humeral sinus is narrowly yellowish white, bordered cephalad by a weak fuscous cloud.

The measurements of the Stellenbosch individual are as follows: length of body, 44.5 mm.; length of pronotum, 10.5; greatest depth of pronotum in profile, 13.2; length of tegmen, 36.5; length of caudal femur, 14.

According to Péringuey (1916) this species is an inhabitant of the Cape Peninsula.

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* Recensio Orthopt., I, p. 140, (1873).

[7] The decolored individual without exact locality, however, shows a few but quite definite scattered small tegminal fuscous maculae.

[8] Kongl. Vetensk. Acad. Handlingar, XXXI, pl. II, fig. 4.

Bullacris ocellata (Thunberg)

1810. *Pn[eumora] ocellata* Thunberg, Kongl. Vetensk. Acad. Handlingar, XXXI, pp. 57, 60, pl. II, fig. 3. [♂; South Africa.]

CAPE PROVINCE: Stellenbosch; November, 1940; (C. A. du Toit); 1 ♂; [A.N.S.P.].

This specimen, with a body length of 50 millimeters, is somewhat smaller than Thunberg's type as measured by Stål ("long. 61 mill."), but is larger than the dimension given for the male of this species by Péringuey ("length 47 mm."). The coloration is as a whole light green, with the pronotal ridge pinkish red, the caudal margin of the pronotal lateral lobes ventrad of the usual position of the humeral sinus edged with yellowish, and the distinctive black (red bordered) maculation of the dorsal half of the pleura very marked. The lateral abdominal ocelli are proportionately somewhat smaller than in Thunberg's rather crude original figure, but their disposition is as there shown.

The only exact localities for this species in the previous literature are those given by Péringuey, i.e. Worcester and Tulbagh, Cape Province, points forty-five miles or less in an air-line distance from Stellenbosch.

Bullacris consobrina (Péringuey)

1916. *Bulla consobrina* Péringuey, Ann. South African Mus., XV, pp. 403, 406. [♂,[9] ♀; Port Elizabeth, Rosmead Junction, Kentani and East London, Cape Province.]

CAPE PROVINCE: Knysna; 1 ♂; [Hebard Cln.]. "Cape Colony"; (J. Wagner); 1 ♂; [Transv. Mus.].

NATAL: (Guerin Cln.); 1 ♂; [Hebard Cln.].

This species is quite close to *B. ocellata,* and as stated by Péringuey has probably been mistaken by most students for that form. Both of the specimens in the Hebard Collection have been labelled *ocellata* by previous students. All three specimens have had their natural coloration affected by methods of preservation, and color notes would be of little value. In size all fall within the 40–53 mm. body length range given for males by Péringuey.

The Knysna and Natal records extend the range of the species somewhat to the west and northeast of the area from which it was previously known.

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[9] See on a following paper under *B. thunbergii* for comments on the restriction of the name *consobrina* to the males originally referred.

Bullacris longicornis (Stål)

1873. *B[ulla] longicornis* Stål, Recensio Orthopt., I, p. 139. [♂; Caffraria.]

Natal: Stanger, Lower Tugela District; November–December, 1921; (R. J. Gardiner); 1 ♂; [Transv. Mus.]. Adams Mission Station, Lower Tulega District; April 11, 1917; (S. G. Rich); 1 ♂; [A.N.S.P.]. Durban; January 12, 1926 (adult), June 12, 1906, November 21, 1909, December 12, 1926; (G. F. Leigh); 1 ♀, 2 juv. ♂, 1 juv. ♀; [A.N.S.P., Hebard Cln. and Transv. Mus.]. Pinetown, Umlazi District; February 14 (adult), March 2 (adult), 4, 6 and 7, 1909, August 21 and 29, 1910 (adults); (G. F. Leigh); 3 ♂, 1 ♀, 6 juv. ♀; [A.N.S.P., Hebard Cln. and Transv. Mus.]. Sarnia;[10] January 20, 1912; (A. J. T. Janse); 1 ♂; [Transv. Mus.]. No exact locality; 1 ♂; [M.C.Z].

It is quite probable, as has been suggested by Péringuey, that a comparison of the unique type of Walker's *Pneumora membracioides,*[11] which is an immature female, with material in the same instar known to be *longicornis,* will show they are identical, and that Walker's name, as the earlier, must be used for the species. However, until this has been clearly established I prefer to use Stål's long recognized name for this insect.

The eight [12] males of this species which I have seen shown there is a definite amount of individual variation in that sex in the relative size of the ocelli and the consequent width of the intervals between the same. As these features have been considered by Stål to be important specific criteria for a number of the species of this genus, it is desirable that the evidence of this series be noted. The following table gives, in millimeters and decimals of the same, the transverse diameter of the median ocellus, of the lateral ones, of the interval between the opposed borders of the lateral pair (taken transversely dorsad of the median one) and that between the borders of the median and lateral ones, taken obliquely.

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[10] I have not been able to locate this place, although it is clearly stated on the label to be in Natal.

[11] Catal. Derm. Salt. Brit. Mus., IV, p. 800, (1870). [[Juv.] ♀; Natal.]

[12] In addition to the specimens above listed I have seen a single male and a single female of this species without locality data.

	Diameter of median ocellus	Diameter of lateral ocellus	Distance between lateral ocelli	Distance between lateral and median ocelli
Stanger	.65	.70	1.50	.70
Pinetown	.85	.90	1.50	.60
Pinetown	.70	.80	1.45	.60
Pinetown	.80	.85	1.45	.50
Adams Mission Sta.	.55	.65	1.70	.80
Sarnia	.65	.80	1.50	.60
No exact locality	.65	.75	1.55	.65

It is evident from these measurements that the distance between the median and lateral ocelli is usually quite distinctly less than the width of the lateral (or "anterior" as Stål calls them) ocelli, instead of "haud vel paullo angustiore" as Stål gives in his key to the forms of the genus. The above figures show there is no fixed correlation of smaller ocelli with greater interspaces or vice versa, and, further, the variation noted is not correlated with general size variation, as the measurements given beyond of the body proportions of the adults will demonstrate.

In coloration the males before me are of a general lime green to absinthe green tone, except for an olive-ocher tendency in one from Pinetown, and that from Sarnia, with the one from Natal without exact locality, are largely chamois, perhaps due to method of preservation. All three of these specimens have an area on the lateral lobes immediately cephalad of the usual position of the humeral sinus bearing a trigonal patch of mummy brown. Correlated with this marking in the same specimens is a series of pale mummy brown vermiculate subocelliform maculations laterad on the abdomen, these alternately larger and smaller, generally two to a tergite (the larger cephalad), arranged in a longitudinally linear series. These abdominal ocelli are not correlated with the mummy brown juxta-spiracular maculae more ventrad on each segment, or the medio-longitudinal infuscation or series of infuscations on the abdominal sternites, all of which are sharply indicated in the clear greenish males, which, however, lack the pronotal and lateral abdominal brownish areas. Clearly the presence of brownish lateral abdominal pseudo-ocelli is, in this species at least, correlated with an intensive type of pattern, also manifest in the pronotal maculation, and their presence or absence is of no value as a specific criterion.

One (Pinetown) of the two adult females shows the three lateral series of silvery bars mentioned by Péringuey when describing the female of *longicornis*.[13] The other female (Durban) shows but little trace of them, so we may infer they can be lost by desiccation, although neither specimen is badly discolored. The very brief tegmina of the female, which are but narrowly visible ventrad of the pronotal margin immediately caudad of the usual position of the humeral sinus, in color are bright sealing-wax red. The six immature Pinetown females represent the three instars preceding maturity, the Durban immature female is in the earliest of these, as is one of the immature males from the same locality, the other of which (December 12) is in the instar preceding maturity.

The specimens before me measure (in millimeters) as follows:

	Length of body	Length of pronotum	Greatest depth of pronotum in profile	Length of tegmen	Length of caudal femur
♂, Stanger	51	22	18	43	16
♂, Pinetown	49	21.8	17.6	44	14.5
♂, Pinetown	53	22	— [14]	42.8	15.5
♂, Pinetown	53	— [15]	16.2	44	15.5
♂, Adams Mission Sta. ..	53	21.5	17.8	40	17
♂, Sarnia	51	20	16	38.6	15.5
♂, "Natal"	52	— [15]	17	42	— [16]
♀, Durban	50	30.5	19.5	— [17]	19.2
♀, Pinetown	52	30	18	— [17]	19

The known range of *B. longicornis* extends from Port St. Johns, Cape Province (Péringuey, 1916) across Natal (Durban, Pinetown, Adams Mission Station, Umkomaas, Pietermaritzburg, Stanger and Sarnia) to as far as Eschowé, Zululand (Uvarov, 1926). It is not definitely known from any elevation higher than that of Pietermaritzburg (Péringuey).

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[13] Ann. So. Afr. Mus., xv, p. 408, (1916).

[14] Highest portion of pronotal crest broken.

[15] Caudal angle of pronotum broken.

[16] Lacking.

[17] The very small tegmina are so largely covered by the margin of the pronotum it is not possible to measure their length without damaging these comparatively rare specimens.

Bullacris thunbergii (Kirby)

1810. *Pn[eumora] papillosa* Thunberg, Kongl. Vetensk. Acad. Handlingar, XXXI, p. 61, pl. II, fig. 5. [♂; South Africa.] (Not *Gryllus papillosus* Fabricius, 1775.[18])

1910. *B[ulla] thunbergii* Kirby, Synnon. Cat. Orth., III, p. 63. [New name for *Pneumora papillosa* Thunberg, 1810 (not *Gryllus papillosus* Fabricius, 1775).]

CAPE PROVINCE: East London; December, 1916; (Dr. Brauns); 1 ♀; [Transv. Mus.].

This specimen is referred to *thunbergii* although in a few respects it is not in full agreement with Stål's 1875 description of Thunberg's material of the female of *papillosa.* It is very probable, however, that these differences are solely individual, and as such I am noting them. The medio-longitudinal crest on the prozona is definitely cut by two transverse sulci, and in addition it has several other depressions which give a total of six or so low serrato-lobules; the dorsal surface of the prozona shows but one, instead of two, oblique, caudad diverging whitish markings, this less marked than the three or four oblique, caudad diverging whitish callose markings on the metazonal disk, these latter more or less definitely joining a longitudinal similar whitish bar, which ventrad parallels, but is well removed from, the lateral borders of the disk caudad of the humeral sinus, the oblique markings often (first or second from head) branching. The lateral silvery-white abdominal markings are pronounced, longitudinally disposed as series but on each tergite strongly oblique, and consisting of a smaller dorsal series, a median large series and a poorly marked ventral one. The caudal margin of the lateral lobes and cephalad some distance along the ventral side of the humeral angle marked with creamy white. The very small and largely hidden tegmina have the narrow exposed section sealing-wax red, the remainder of the olive-green of the general coloration.

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[18] Syst. Entom., p. 827. [Cape of Good Hope.] Kirby, with Fabricius' type before him, considered that author's species to be a member of the genus *Pneumora* of most authors (= *Bulla* as here understood). Thunberg did not use the name *papillosa* as new, but considered the species here treated to be that named by Fabricius. Stål in 1873 (Recens. Orth., I, p. 142) considered that *Pneumora obliqua* Thunberg, the type of which was then before him, was based on an immature individual of *papillosa* as understood by Thunberg. Kirby, however, disagreed (Syn. Catal. Orth., III, p. 65, (1910)) and considered that instead it represented the immature condition of *Pneumora* (*Cystocoelia* of authors) *inanis* (Fabricius). I feel the latter conclusion is definitely the more probable explanation.

This specimen measures as follows: length of body, 51.5 mm.; length of pronotum, 29; greatest width of pronotum, 13; greatest depth of pronotum, 15.7; ventral exposed length of tegmen, 5.37; length of caudal femur, 17.3.

We have no previous exact information on the distribution of this species. All the older records are very general in their locality citations, and we are unable to find what support there may be for Kirby's 1910 quotation of " Natal " as the locality. The latter author apparently had no material of the species at that time, as he failed to mark it as represented in the British Museum collection, and no earlier student known to me gives Natal. We know that Thunberg's explorations carried him eastward close to the East London area, very probably into its territory, even if the present species is localized. Péringuey in 1916 said he had not met with this species, but his description of the female sex of his *consobrina* strongly suggests the present individual, which clearly is not the female of what I am considering *consobrina* on the basis of males which agree with the description of that sex of Péringuey's species. As the male stands first in Péringuey's description of *consobrina* I would restrict the name to that sex, although we are unable to say which of the four localities originally cited were represented by males.

In addition to the species of *Bullacris* reported in the preceding pages, I have before me from the Transvaal Museum an immature male, apparently in the second instar preceding maturity, which I hesitate to assign specifically. It is apparently near to, if distinct from, *B. longicornis,* and is labelled Pretoria, December 20, 1909, taken by P. Pienaar. I do not care to record this specimen specifically, but unless the locality is incorrect this is the first record of the genus, and in fact of the Pneumoridae, known to me from the Transvaal.

Whether Westwood's genus and species *Physophorina livingstonii*[19] is based on an immature specimen, and if so whether it will prove to be a member of the genus *Bullacris,* or a quite distinct genus unknown in the adult condition, remains for the future to determine.

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[19] Thesaur. Entom. Oxon., p. 175, pl. 32, fig. 5, (1874). [[Juv.?]; Zambesi.]

BULLA Linnaeus

1758. *Gryllus* (*Bulla*) Linnaeus, Syst. Nat., x, ed., I, p. 427. Genotype (by designation of Kirby, 1890): *Gryllus* (*Bulla*) *variolosus* Linnaeus. *Pneumora* of Thunberg, 1775 in part, and of subsequent authors, but not as limited by first designation of type species.

1941. *Physemacris* Roberts, Trans. Amer. Entom. Soc., LXVII, p. 19. Genotype (by original citation): *Gryllus* (*Bulla*) *variolosus* Linnaeus.

Roberts[20] has recently shown that *Bulla* Linnaeus, if retained as a valid generic name, must be used in place of *Pneumora* for the generic entity to which authors for many decades had restricted the last mentioned name. In conformity with the earliest fixation of type species, *Pneumora* must be shifted and now used in place of *Cystocoelia* Stål, however unfortunate this transposition of names may appear to be.

The new generic name *Physemacris* recently erected by Roberts, is necessary if *Bulla* Linnaeus as a genus of Orthoptera is considered invalid. I have already given my personal reaction to such a claim in discussion under the genus *Bullacris*. In consequence I shall continue to use *Bulla* for the present genus.

Bulla variolosa Linnaeus

1758. *Gryllus* (*Bulla*) *variolosus* Linnaeus, Syst. Nat., X ed., I, p. 427. [♂ (according to Stål); "Indiis."[21]]

CAPE PROVINCE: Stellenbosch; November, 1940; (C. A. du Toit); 2♂; [A.N.S.P.]: October, 1925; (Dr. H. Brauns); 1♂; [Transv. Mus.]. "South Africa"; 1♂, 1 juv. ♀; [Hebard Cln. ex Geneva Mus.]. No data; 2♂; [Transv. Mus. and M.C.Z.].

All the adults of this genus now before me are clearly referable to *variolosa*, although I am unable to say how *papillosa* of Fabricius differs from *variolosa* Linnaeus, if they are distinct. The type of Fabricius' species is in the British Museum (Natural History) and Kirby allowed it to stand in his catalogue as a distinct form of the present genus. Discoloration, however, might account for the few differences from the average of *variolosa* which may be noted in the fairly ample original description of *papillosa*.

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[20] Trans. Amer. Entom. Soc., LXVII, pp. 17–19, (1941).

[21] All four species of Pneumoridae described by Linnaeus in 1758 were said to be from "Indiis," doubtless due to having been brought back by an Indiaman which called at the Cape of Good Hope, as was then customary. The usual lack of immediate labelling of these early collections would readily explain what probably happened.

The extent in this species to which elements of the callose whitish pronotal pattern are fused or distinct is seen to vary individually in the specimens before me, but the general character, placement and trend of the major units remains essentially the same in all.

Exact localities for the forms of this genus are almost nonexistent in past literature, and available material often lacks this vital information. In consequence it is hardly possible to estimate, even in an approximate fashion, the exact area of distribution of a species such as the present one, which has been known for over one hundred and eighty years.

I have before me, from the collection of the Transvaal Museum, a male of this genus in the instar preceding maturity, taken at Willowmore, Cape Province (October 23, 1920; Dr. Brauns). The specimen is most strikingly barred and blotched longitudinally with callose silvery-white areas, as well as many similarly tipped tubercles or simple punctae. It appears to be distinct from *B. variolosa,* but adults would be necessary to determine this. The specimen, however, demonstrates the presence of the genus as far northeastward as the border of the Great Karroo. To the northward of the Cape region *Bulla* is known to range as far as Namaqualand (*B. namaqua* (Péringuey)).

PNEUMORA Thunberg

"1775. *Pneumora* Thunberg, Vet.-Acad. Handl., XXXVI, p. 254." Genotype (by designation of Guérin, 1828): *Pneumora sexguttata* Thunberg = *Gryllus inanis* Fabricius.

As Roberts has recently shown *Pneumora* Thunberg, as restricted by first type designation, must replace *Cystocoelia* Serville 1839,[22] based on the same species.[23] This entails a shift of the classic name *Pneumora* and the suppression of *Cystocoelia,* from which there appears to be no escape.

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[22] Hist. Nat. Ins., Orth., p. 713.

[23] Serville included three supposed species, *scutellaris* Latreille, *sexguttata* Thunberg and *immaculata* Thunberg. The first two represent the male and female sexes of the same species (= *inanis* Fabricius). Kirby (Synon. Catal. Orth., III, p. 65, (1910)) gives his "no. 1" as type, this being *inanis,* under which stand as synonyms *scutellaris* and *sexguttata.* It is logical to select *sexguttata* Thunberg, the older of these names, as the exact genotype of *Cystocoelia;* Kirby's specific selection is clear and definite, but his nomenclatorial restriction is not precise, owing to his method of indication by numbers.

Pneumora inanis (Fabricius)

1775. [*Gryllus*] *inanis* Fabricius, Syst. Entom., p. 827. [♂; Cape of Good Hope.]

CAPE PROVINCE: East London; December, 1922; 1 ♀; [Von der Linde Cln.]

No locality; 1 ♀; [Transv. Mus.].

These two show considerable difference in the details of the silvery markings of the pronotum, tegmina and abdomen. In one (that without data) there are four clearly marked and regularly placed pairs of subsigmoid dashes on the pronotal disk, of which the fourth, or caudal, is the smallest and weakest, while the silvery ventral border of the tuberculate lateral carinae of the disk bears a short branch marking on the ventral side near the middle; the tegmina in this specimen have the more distal of the two discoidal silvery areas larger and crudely reniform in outline; the lateral abdominal silvery markings are larger and less elongate. In the other specimen (from East London) the pronotal disk markings are three paired (the caudal pair of the other specimen lacking), smaller, narrower and not at all subsigmoid, there is no branch to the ventral pale bordering of the lateral carinae; the distal pair of discoidal tegminal markings is smaller, more tear-shaped in outline; the lateral abdominal pale markings are smaller, narrower and more linear. In addition the base color of the pronotum of the specimen without locality is in part ochraceous, which, however, I am certain is due to fading of the normal green tone. The limbs of this specimen are also more rufescent than in the East London female, which latter has them a pale purplish gray.

The measurements (in millimeters) of the specimens now in hand are as follows:

	Length of body	Length of pronotum	Length of metazona of pronotum (medio-dorsal)	Greatest width of pronotal dorsum	Total exposed length of tegmen	Length of caudal femur
♀, East London	86	40	34	17.7	35	21.5
♀, no locality	85	37	31.3	19	32	21.5

Past literature presents virtually no information as to exact localities at which this species has been taken, so it is quite impossible to ascertain definitely what the limits of the distribution of this species, and incidentally of the genus, may be. Apparently it covers the territory between the Cape region—the classic Cape of Good Hope—and East London, but how far to the northward along the coasts, or into the interior, remains to be determined.

SHORTRIDGEA Péringuey

1916. *Shortridgea* Péringuey, Ann. South Afr. Mus., xv, p. 412. Genotype (by monotypy) : *S. miranda* Péringuey.

This genus was founded by Péringuey on material referred by him to a single species, but Uvarov has shown that this was composite,[24] and that two species of *Shortridgea* are represented. The original pair of the genotypic *S. miranda,* from Port St. Johns, Cape Province, however, was figured by Péringuey, and forms the basis of the genus. I have seen no material of *S. miranda,* but I have before me both sexes of the Tanganyikan *S. absidata* (Karsch). Uvarov considers that the genus can readily be distinguished from *Pneumora* (*Cystocoelia* of authors) " by the sharp humeral heels of the pronotum." While I know the male sex of *Pneumora,* as here understood, only from the literature, the female sexes of the two genera show a number of other features which serve to separate them very readily.

In the female of *Shortridgea* the pronotum is very strongly inflated and bullate to an even greater degree than it is in the male sex of the same genus, and its texture and surface sculpture is as in that sex, instead of the dorsum being very much lower, flatter, hardly at all inflated and its texture coriaceous instead of papery, and its surface coriaceously impresso-punctate without vein-like longitudinally disposed carinulae, as in *Pneumora.* While the lateral humeral keels of the pronotum in the female of *Shortridgea* are definitely marked, tuberculate and projecting latero-dorsad of the lateral lobes of the pronotum, they project but little laterad in the male sex—in fact no more so than in the female of *Pneumora* (*Cystocoelia*). In both sexes of *Shortridgea* the prozonal portion of the pronotum has two distinct transverse sulci laterad, in addition to the principal one which segregates the metazona, and these do not sever the median carina; in the female of *Pneumora* (*Cystocoelia*) but a single one is present on the prozona and this does sever the median carina. The lateral lobes in *Shortridgea* carry no indication of the longitudinal series of heavy spiniform tubercles seen in the female of *Pneumora* (*Cystocoelia*). As a whole the female sexes of the two genera are very distinct, and can be separated at a glance.

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[24] Ann. South Afr. Mus., xxv, p. 342, (1928).

Shortridgea absidata (Karsch)

1896. *Cystocoelia absidata* Karsch, Entom. Zeitung, Stettin, LVII, p. 245. [♂; Mpwapwa [, Tanganyika Territory], East Africa.]

TANGANYIKA TERRITORY: Morogoro; May 14, 1917; (A. Loveridge); 1 ♀; [M.C.Z.]. "German East Africa"; 3 ♂; [A.N.S.P.].

The male specimens here recorded agree perfectly with Karsch's description, which was drawn from a specimen taken by Franz Stuhlmann at Mpwapwa, except that all are somewhat under the original measurements.

The female examined is that reported and briefly described by Loveridge in 1923.[25] While that sex of *absidata* had not previously been described, Loveridge's comments are sufficiently ample to enable one to reorganize this remarkable insect. Certain of the color notes given by him are little evident in the specimen which has now been dried for twenty-four years.

The four specimens examined measure (in millimeters) as follows:

	Length of body	Length of pronotum	Greatest width of dorsum of pronotum (across humeral angles)	Greatest depth of pronotum	Exposed length of tegmen	Length of caudal femur
♂, Tanganyika ("German East Africa") .	66	36.5	17.5	25	62.5	15
♂, Tanganyika ("German East Africa") .	67	37.5	18	26.7	63.5	14.7
♂, Tanganyika ("German East Africa") .	65	37	18	24.5	60	15
♀, Morogoro, Tang. ...	107.5	64	36	35.7	34	22.8

The only additional records in the literature on the occurrence of this species are those by Miller,[26] who gives capture records of males from Muhenda and Kilosa, and an occurrence report from Myombo, seven miles from Kilosa, Tanganyika. Miller notes that both of the former were taken at light, the first at a camp fire, and the second attracted to a paraffin lamp in a house. At Myombo it was said to have been attracted to a camp fire. Miller considers the species as "apparently abundant but rarely seen owing to its arboreal habits." He further states the stridulation is heard at about an hour before daybreak, i.e. 4.30 to 5 A.M., and that it consists "of a series of bell-like notes repeated six or seven times." [27]

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[25] Proc. Zool. Soc. London, 1923, p. 1038, (1923). (Specimen determined by Uvarov.)

[26] Trans. Entom. Soc. London, 1929, p. 66, (1929).

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[27] In this connection it may be interesting to compare Thunberg's comments concerning South African pneumorids, although we are not aware of the species on which his remarks were based. At Thé Fontein, Cape of Good Hope, when writing in September, 1772 ("Travels in Europe, Africa and Asia, made between the Years 1770 and 1779." Second Edition. London. Volume I, p. 150. 1795) he says, "The oppblazers (*pneumora*), a kind of grasshopper, were caught in the evening. After sunset they begin to make a singular noise, by rubbing their barbed hind-legs against their empty and transparent stomach. It was supposed that this sound was heard at a great distance. As I perceived that these, like many other nocturnal insects, were fond of light, I ordered a large fire to be made in the field, near which they were caught, while they were marching up to it. Their whole body is, as it were, a bladder, and so empty, that these creatures cannot be carried about stuck through with a pin, like other insects." Further in volume II of the same work, Thunberg notes in November, 1773, at Swellendam; "The Larvas, or half-grown grasshopper, or (of) the species called *Pneumora,* were seen in the greatest abundance both here and elsewhere on the bushes; but in the day time, neither I nor any of my companions could find one of them in a perfect state and winged, which astonished me much."

DIFFERENTIATION BETWEEN TOXIC AND SUFFOCATING EFFECTS OF PETROLEUM OILS ON LARVAE OF THE HOUSE MOSQUITO (CULEX PIPIENS L.)

(DIPTERA)

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(Plates XIV to XVII)

Ever since the introduction of kerosene for mosquito control near the end of the last century there has been discussion as to how petroleum oils kill insects.* The simple question of whether petroleum oils kill by causing suffocation or by direct toxic effect is still unanswered. Considerable concrete evidence has accumulated showing that the more volatile petroleum oils do have a directly toxic effect. It has been presumed that since the non-volatile oils kill very slowly and are generally classed as non-toxic, they must cause only asphyxiation. Whether or not asphyxiation is an added factor in death due to toxic oils is not shown in the literature. This

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* Dr. T. Hatch of the Department of Public Health has called my attention to a quotation from an editorial in the Philadelphia "Daily Advertiser" for August 29, 1793 (quoted in Scott, H. H. "A History of Tropical Medicine." Williams & Wilkins, Baltimore. 1939, p. 204). This editorial describes and recommends the use of oil to kill mosquito larvae, the author stating that he discovered it accidentally. In addition to recommending this, the author describes how the reader may test the treatment and in rough terms gives the quantity of oil required. 1793 was the year Philadelphia had its terrible epidemic of yellow-fever, and the recommendation was published partly because mosquitoes were so "distressing" to the sick. This editorial has been overlooked in American entomological literature, and the introduction of kerosene for mosquito control has been generally credited to L. O. Howard ("Insect Life," vol. 5, pp. 12–14 and 199. 1892). Dr. Howard disclaimed originating the idea but had no inkling that it had been published so long as 99 years earlier. Credit for developing, publicizing and obtaining general acceptance for the method will still remain with Dr. Howard but the origin of the idea and a demonstration of its feasibility antedates Howard's experiments by almost a full century, and credit for this belongs to the editor of the Philadelphia "Daily Advertiser."

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paper presents experiments showing that (1) suffocation and oil-toxicity produce different histo-pathological pictures in the central nervous system; (2) either or both may be produced in premortem larvae; (3) as usually applied in mosquito control toxic (i.e. volatile) petroleum oils produce both effects; and (4) immersion in aerated paraffin oil ("non-toxic") probably does not kill dry mosquito larvae by asphyxiation.

LITERATURE

As early as 1918 Freeborn & Atsatt demonstrated that oils penetrate throughout the tracheal system of mosquito larvae, that their toxicity is proportional to their volatility, and that the vapors of these oils can also kill mosquito larvae. Even earlier Sen (1914) and Macfie (1917) had shown that kerosene vapors alone could kill. These experiments have been elaborated by Hacker (1925), Ginsburg (1927, 1929) and Sicault & Messerlin (1936). Ginsburg in his 1927 paper abstracts most of the earlier literature and in his second paper analyzes the situation particularly from the practical viewpoint of finding the most efficient larvicide. These authors demonstrate beyond question that the volatile petroleum oils possess directly toxic effects since the vapors alone kill readily. Watson (1941) emphasizes the importance of water-soluble toxins in the oils, in spite of opinion to the contrary expressed by earlier authors.

Other indirect evidence against suffocation came from the work of Macfie (1917) who showed that although kerosene kills in a short time, larvae of the yellow-fever mosquito (*Aędes aegypti* L.) could live commonly for twenty days in well-aerated water without coming to the surface for atmospheric air. Somewhat similar experiments with the same species had been performed by da Costa Lima (1914) and Sen (1914) with similar results but less reliable technique. da Costa Lima reports one specimen surviving fifty-three days submergence. These data indicated, as these authors pointed out, a cutaneous respiration. This is supported by Wigglesworth (1930) who succeeded in completely blocking the respiratory tubes of *Aedes aegypti* larvae with "non-toxic" paraffin oil and yet having some larvae complete their growth, pupate and emerge as adults. Later (1933) he showed by spontaneous aggregation of the flagellate protozoan *Polytoma* that diffusion of oxygen took place through all parts of the body surface (most at base of the anal gills) and by the use of indicator dyes that carbon dioxide likewise diffused out through the body wall. Since all gases left the tracheae when they were blocked with oil, respiration must have been independent of the tracheal system, gaseous diffusion taking place through the tissues, blood and body wall. (See also Fox, 1920.)

Mosquito larvae of the genus *Mansonia* normally attach their modified respiratory siphons to the roots of aquatic plants, and are thought to obtain their oxygen from air within the plant. Yet Galliard (1939) reports that fourth instar larvae of this genus can live, transform into pupae and then adults in the absence of plants.

The experimental data on extended submergence deals almost exclusively with *Aedes aegypti.* The data do not hold for all species of mosquitoes. Macfie (1917) reported *Aedes aegypti* and *Culex thalassius* Theo. living indefinitely but *Culex fatigans* Wied. (now called *C. quinquefasciatus* Say) dying in less than one day. Sen (1914) comments that *Culex microannulatus* Theo. (?) is less tolerant to submergence than *A. aegypti.* Koch (1920) using a closed tubular system with known and controllable amounts of oxygen and carbon dioxide reported only a slight amount of cutaneous respiration in *Culex pipiens.* Ginsburg (1929) used mostly *Culex pipiens* and had none survive more than one day. I was also unable to keep submerged larvae of *Culex pipiens* alive as long as has been recorded for *Aedes aegypti.* Younger larvae are also more resistant to submersion (da Costa Lima, 1914; Macfie, 1917, and the present author). Recent quantitative studies of cuticular respiration of the least tolerant species (*C. pipiens*) by Fraenkel & Herford (1938) will be discussed later.

All of the above data, plus data presented in this paper, point to a large amount of respiration taking place through the cuticle. Under some circumstances this may be entirely adequate for the organism. Nevertheless, the above data against suffocation show only that under certain circumstances mosquito larvae can survive without access to atmospheric air entering via the tracheal system. This does not mean that oils, toxic or non-toxic, cannot and do not asphyxiate. More will be said on this point later.

The literature on toxicity of petroleum oils to other insects is far more complicated and conflicting. Part of the older literature is abstracted by Swingle & Snapp (1931) and more recently Shepard (1939) and Hoskins (1940).

MATERIALS AND METHODS

Mosquito larvae have certain advantages as experimental animals. Most important, the transparent cuticle of mosquito larvae makes four criteria of death available: (1) body movements including mouthparts, (2) "swallowing" reflexes of the pharynx, (3) heart beat, which is clearly reflected by causing synchronous pulsations of the longitudinal dorsal tracheal trunks, and (4) skin twitches. A further check was available by recording the reaction in the fixing fluid to which larvae were transferred before opening. The heart beat was chosen as the chief criterion.[1] Additional reasons for using mosquito larvae were that considerable study has already been given to the use of petroleum oils as mosquito larvicides, and the more personal reason that the author was already familiar with the handling of mosquito larvae and with their anatomy.

Throughout these experiments, which have extended over more than a year, larvae have been obtained as needed from an "autogenous, homodynamic, stenogamic" strain that maintains itself unattended and breeds throughout the entire year in the vivarium of the Zoological Laboratory (Richards, 1941). Most of the experiments have been run during the winter and spring months, at which time this must be an inbred line. During the summer and fall months there is ample opportunity for introduction from outside.

Various experimental methods were employed. For suffocation a series was prepared ranging from known premortem individuals

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[1] Of course, the heart beat is not a simple criterion, and its cessation may occur prior to death though it usually occurred in these experiments at about the same time (compare Tischler, 1935). In some cases the heart beat continued for a long while (up to several hours) after other responses ceased; in most cases it stopped at about the same time as bodily reflex ability; in a number of cases it was interrupted or even seemed permanently stopped before reflex movements. Despite these variations the heart beat was the most reliable general index found. For notes on variation within lots of mosquito larvae see also Phillips & Swingle (1940). For review of recent literature on insect heart beat see Wigglesworth (1939), Hoskins (1940) and Wixforth (1924). See also discussion in the present paper.

(lethargic but capable of recovering), through stages immediately preceding and succeeding death, to about fifty hours postmortem. With terrestrial animals suffocation is commonly produced by the use of oxygen-free atmospheres in a closed system. With aquatic insects suffocation may be produced more simply, since boiling water drives out the gases. The technique was to fill the tubes being used for the experiment with actively boiling distilled water, cover, cool rapidly, add the larvae and then insert a tightly-fitting previously water-soaked cotton plug and push this well down in the vial. This plug must be tight or larvae will wriggle past it, and it must be previously soaked or it will carry small air-bubbles with it. Theoretically some air must (and does) enter the water but this is slight and simple diffusion does not take appreciable amounts down to the levels used within the time taken for the experiment. Some currents are set up by the insertion of the cotton plug but the practical insignificance of any oxygen that may have entered is shown by the fact that several variations of this technique have been used with a total of over three dozen experiments and yet with consistent results.

Winkler tests [2] made on the boiled water used showed 0.13 mg. to less than 0.20 mg. of oxygen per 100 cc. of water, and part of this is introduced during the test. At this low oxygen concentration larval mortality was constant (all larvae die within a few minutes of the same time) and other normally aquatic animals such as the cladoceran *Daphnia* also die promptly. Water in equilibrium with air contains 0.9–1.0 mg. of oxygen per 100 cc., and supports mosquito larvae without additional aeration up to forty, sixty or even seventy-two hours although most of them die in four to six hours.

For application of the oils five methods were tried: 1) larvae in a vial of water the surface of which was covered with the oil being used; 2) larvae in a drop of water on a microscope slide under a supported cover glass, the oil being applied as a circle around the edge of the cover glass (Wigglesworth, 1930); 3) larvae, dry or damp, immersed in a drop of oil under a cover glass; 4) larvae, dry or damp, immersed in a layer of oil on the bottom of a watch glass or petri dish; and 5) larvae in a supported film of water to which oil may be added (See Williams, 1939). All of these methods have some disadvantages. In the first it is difficult to observe the specimens satisfactorily; in the second and third observation is easy but the confinement between glass may enhance suffocation; the fourth is excellent for studies of immersion in oil but is not wholly satisfactory for observing specimens in water covered with oil; the fifth provides ready observation and a maximum of aeration but the larvae are inclined to become immersed in the oil and the lower surface tension of the oil frequently breaks the film. Methods 2, 3 and 4 were used principally.

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[2] American Public Health Association, 1933.

Dosage could not be controlled and part of the variation in time of killing certainly depends on this. In water some of the larvae persist in remaining away from the oil or keep their siphons closed so that little enters the tracheae. No technique was found that would overcome this. Even among specimens immersed in oil considerable variation occurred as to the amount entering the tracheae. Fortunately the main thesis of this paper proved largely independent of this variable.

Larvae were handled both individually and in groups. Records included notes taken throughout the experiment and particularly the duration of treatment and the condition of the specimens at the time of fixation. Unless otherwise explained, all statements refer to specimens known to be premortem according to the criteria given above. All tests were made on fourth (last) instar larvae, the more exact developmental ages of which can be checked by the degree of development of the imaginal discs.

For histological examination specimens were fixed in a cold, freshly prepared mixture of 95% ethyl alcohol and glacial acetic acid (95 parts and 5 parts by volume respectively). Specimens were transferred to this mixture intact, their reactions if any recorded, and then the mouthbrushes and the entire anterior half of the head torn away with needles and the thorax and abdomen opened to permit ready penetration. Controls were placed directly in the fixative and there opened. After washing out the acetic acid, specimens were embedded in paraffin plus bayberry wax; sectioned at five microns and the entire ribbon mounted as complete serial sections. To reduce the work involved only the head and thorax were sectioned for many specimens, the abdomen being retained in case it should be wanted. The sections were stained, usually six and one-half hours, in a 1% aqueous solution of toluidine blue. This technique stains the nuclear contents and also the basophilic granules of the cytoplasm (Nissl bodies). Though commonly referred to as the Nissl technique it is by no means specific for these structures to the exclusion of other tissues. All basophilic substances stain a deep blue or bluish-black, some of the glandular cells of the gut staining considerably more heavily than the nerve cells (see fig. 9).

In some cases where only knowledge of the degree of chromatin clumping was desired, brains and suboesophageal ganglia (and in some cases the other parts of the nervous system) were dissected out *after* fixation, stained *in toto* in Mayer's haemalum and mounted as a partially crushed whole mount (table 3).

The technique and the fixing fluids do not produce the abnormal effects found. This is shown by the normal histology of the control animals subjected to the same histological technique at the same time as the experimental animals. In experiments in which larvae were immersed in oil, it is conceivable that the oil film might affect penetration of the fixing fluid. In practice this was circumvented by placing the larvae on blotting paper to remove all except a thin film of oil, and then tearing off the entire anterior half of the head to allow immediate penetration of the fixing fluid. Proof that this technique is satisfactory comes from those experiments in which larvae immersed in oil for various periods of time showed no chromatin clumping.

The petroleum oils used were No. 1 (kerosene), No. 2 and No. 4 fuel oils being sold here commercially by the Atlantic Refining Company. The paraffin oil was a chemically pure grade (viscosity at 25° C. = 80 sec., Saybolt Furol; at 50° C. = 25 sec., Saybolt Furol). "Nujol" is the trade name of a common medicinal mineral oil; it is a more highly refined paraffin oil.

NORMAL HISTOLOGY OF THE CENTRAL NERVOUS SYSTEM

No description of the nervous system of mosquito larvae is available, and only so much as is needed for the following sections will be presented here. Anatomically the nervous system consists of a supraoesophageal ganglion (brain) with large optic lobes, circumoesophageal commissures, suboesophageal ganglion, three distinct thoracic ganglia and eight separate abdominal ganglia. The general structure of these ganglia and of the cells may be found in Hanström (1928) or any of the comprehensive textbooks on entomology. (Figs. 1–3.)

The cells of the central nervous system vary from two to fifteen microns in diameter exclusive of the processes, with most of the cells in the range of four to seven microns. Thus, even the largest cells are smaller than the smallest cells of the spinal ganglia of rats (Beams & King, 1935). In the smaller cells the nucleus is almost as large as the entire cell, the cytoplasm consisting of only a very thin darkly-staining layer in which little detail can be seen. The average cells (4–7 microns) have a cytoplasmic layer approximately one micron thick; in this cytoplasmic layer considerable differentiation of chromidial material is visible, especially in surface view of cells in which most or all of the nucleus has been cut off (figs. 14 and 20). The most detailed cytoplasmic differentiation is seen in the largest cells in which the cytoplasmic layer reaches a thickness of five microns or more (figs. 15, 17, 18, 21, 23, 24), although some large cells also have a thin cytoplasmic layer (figs. 16 and 22). In general the picture of chromidial substance is similar in all cells but in some the network is heavier than in others.

Insect nerve cells have no myelin sheaths. Not only are no such structures discernable in ordinary histological sections but no special intercellular substance was seen in formalin-fixed frozen sections stained with Sudan IV.

The vertebrate nerve cell has at least three discrete cytological components: the mitochondria, neurofibrils and chromidial substance (Nissl bodies). Only one of these will be considered, namely the chromidial substance that stained with toluidine blue. In vertebrate nerve cells this was considered an artifact until photographed in the living cell with ultra-violet light by Weimann (1925). Subsequently this material has been shown to retain its individuality after the freezing-drying technique (Bensley & Gersh, 1933) and to be displaced as discrete, highly viscous bodies to the centrifugal pole (Beams & King, 1935). Both centrifugation and histochemical studies indicate they are essentially protein (see Einarson, 1935). Whether or not the cytoplasmic structures staining with toluidine blue in the insect nerve cord are the same as the chromidial or Nissl substance of the vertebrate nerve cell is unknown. All that can be said is that they have a similar structure in those cells large enough to show details and that they stain similarly. They look more like the photographs published by Weimann (1925) and Bensley & Gersh (1933) than like the figures usually given in textbooks.[8] In insects, the absence of myelin sheaths, the reaction to various drugs (Roeder, 1939) and the reaction of the chromidial picture to suffocation (this paper), all point to similarity to the sympathetic rather than the parasympathetic system of vertebrates.

Three abnormal effects in the nervous system of mosquito larvae will be considered: (1) chromatin clumping in the nuclei, (2) separation of cells usually with fiber degeneration, and (3) a more reticular chromidial picture. These effects tended to be generalized and to be shown by all cells of the central nervous system. When only parts of the central nervous system were affected, the optic lobes and other regions with small cells tended to be normal. Larger cells showed more effect. In part this is an illusion due to more ready classification in some areas but in part it seems to reflect a real difference of different regions. Results on this point were not entirely consistent (and not extensively studied) and the results may depend on various dosages received by the different ganglia and cells—a fortuitous variable that could not be accurately checked.

EFFECTS OF SUFFOCATION

Suffocation by submersion in water without oxygen.—As stated in the section on methods, this water was not entirely free of oxygen but always tested at less than 0.2 mg. of oxygen per 100 cc. In such water larvae sink to the bottom and become lethargic in ten to twenty minutes and die in sixty-five to eighty minutes, the average being approximately seventy minutes (table 2). Great variation is noted in time for larvae to die when submerged in aerated water; no comparable variation occurs in water practically devoid of oxygen showing that individual differences in tolerance to asphyxiation under near-anaerobic conditions is indeed slight. Experiments with complete absence of oxygen might give faster asphyxiation but the histological results would doubtess be the same since similar results were obtained by *in vivo* observations in a gas chamber by Buck & Boche (1938).

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[8] For further details on the chromidial substance of vertebrate nerve cells see textbooks on neurology and especially Sheinin (1932), Einarson (1935), Bethe & Fluck (1937), and references cited above.

In the central nervous system the chief histological result of suffocation is a clumping of the chromatin around the nucleolus leaving the remainder of the nucleus filled with clear fluid (figs. 4, 19, etc.). This phenomenon is distinct from the nuclear shrinkage that is sometimes produced in fixation and which can be produced by the injection of hypertonic solutions (Buck & Boche, 1938). In asphyxiated mosquito larvae this phenomenon also occurs in cells of other tissues, as one would expect, but is more extreme in the nervous system than in other tissues. Conceivably this variation might be due either to differences in the quantity of respiration of the various tissues or to differences in susceptibility to chromatin clumping. Direct evidence on this point is lacking.

Whenever larvae of *Culex, Sciara, Chironomus* or *Drosophila* were subjected to anaerobic or near-anaerobic conditions chromatin clumping invariably followed (Buck & Boche, 1938, and present paper). Asphyxiation, therefore, always produced chromatin clumping. This does not mean that chromatin clumping is produced only by asphyxiation. In fact, one other cause of this clumping (injury by pressure) has already been recorded by Buck and Boche (1938) and some other causes are known but not yet published. However, with the application of experimental conditions such as were used for the experiments reported here, the absence of chromatin clumping indicates that asphyxiation has not occurred and the presence of chromatin clumping indicates that asphyxiation has occurred. The tests on which this statement is based will be presented in subsequent sections but final evaluation must await explanation of the phenomenon of chromatin clumping.

A second result of asphyxiation is the production of a more reticular chromidial picture (compare figs. 15 and 18). However, the extensive chromatolysis and other types of lesions reported for the vertebrate brain as a result of anemia were not observed (see, e.g. Gildea & Cobb, 1930). This is more comparable to the absence of fatigue changes reported for sympathetic ganglion cells of vertebrates (Scarborough, 1938).

No detailed study was made of possible cytoplasmic effects on other tissues. The chromatin clumping can be a general phenomenon as already mentioned.

No differences in this general picture can be detected in lethargic individuals capable of recovering, specimens at about the time of death and specimens definitely postmortem about thirty minutes. In this series specimens were sectioned after thirty-five min. (lethargic), seventy min. (approximate time of death), and one-half, one, two and one-quarter, six and one-quarter, twelve, twenty-four and fifty-one hours postmortem. Postmortem degenerative changes begin to be visible within one hour after death and progress with time. Eventually the tissues all degenerate and bacteria become numerous throughout the body. In the nerve cord during postmortem degeneration the cells become widely separated but tend to retain their identity, cytoplasmic details become obscured and the staining rather dark and uniform (chromatolysis), the nerve processes degenerate and the fiber tracts become irregular (fig. 13). With advanced degeneration and chromatolysis it becomes impossible to distinguish chromosome clumping or even nuclei. These degenerative processes do not occur as a direct result of asphyxiation but are due to postmortem degeneration. It is to be emphasized that no demonstrable premortem separation of cells, degeneration of fibers, or separation of fiber tracts from cell layers occur as a direct result of suffocation (figs. 4–7). However, somewhat similar processes with less or no chromatolysis may occur *premortem* in individuals being treated with volatile and toxic petroleum oils (see next section).

Suffocation by submersion in aerated water.—(Tables I and II.) As noted in the preceding section considerable variation in results occurs. Commonly, if twelve fourth instar larvae are submerged in 100 cc. of aerated water, two or three will die in two to two and one-half hours, half will be dead in four to six hours, nine or ten will be dead in about nine hours, and the remaining two or three will live anywhere from twelve to forty-eight hours or sometimes longer. Longest survivals were with isolated larvae, several of which survived more than seventy-two hours. In these experiments the aeration of the water was not maintained and the oxygen concentration fell during the experiment. No attempt was made to test survival in water maintained in equilibrium with air (for apparatus see Macfie, 1917), or in water saturated with oxygen instead of air.

Numerous measurements were made of the oxygen content of the water before and after experiments (Winkler method). For these tests larvae were placed either in distilled water or in a diluted Ringer's solution (0.13% NaCl, 0.004% KCl, 0.004 $CaCl_2$). No simple correlation was found between survival and oxygen tension or oxygen consumption. The following excerpt of some cases from one experiment will illustrate this point (table 1):

TABLE I. Mortality and oxygen consumption of submerged larvae Volume of water approximately 100 cc. in each case.

	Time in hours			Oxygen		
	First death	Half dead	All dead	At start (mg. per 100 cc.)	At end (mg. per 100 cc.)	Consumption (mg.)
6 larvae	4	5¾	8¼	0.996	0.954	0.042
6 larvae	2½	2¾	3	0.775	0.707	0.068
7 larvae	2½	2¾	over 12	0.791	0.680	0.111

In these selected cases we would expect oxygen consumption to be greater in the first lot than in the second two lots instead of the reverse. Oxygen consumption, therefore, is not directly related to the initial oxygen concentration or to the survival time. Yet there is a relation between the initial oxygen concentration and the length of time taken for half the specimens to die. The above agrees in principle with Koch's results with this species but contrasts with the definite correlations found for larvae of the beetle *Donacia* (Hoffman, 1940).

One of the reasons for the wide discrepancy frequently found in different lots of larvae is due to differences in the culture water. Larvae from one subculture to which commercial yeast cake and sugar had been added seemed totally incapable of cutaneous respiration, after they had been washed in distilled water and were tested in distilled water. In five vials each containing 100 cc. of distilled water in which the oxygen content was respectively 0.921, 0.899, 0.621, 0.296 and 0.162 mg. per 100 cc., these larvae became lethargic and died in sixty-five to seventy-five minutes (six larvae per vial). This is the same time as found for death of normal larvae in virtually non-aerated water. Checks made at this time showed that the oxygen concentration in the first vial (0.921 mg. O_2) was unchanged within the inherent error of the Winkler method, that the results were not affected by the amount of water (specimens submerged in approximately 2800 cc. of culture water all died in seventy to eighty minutes), that specimens allowed access to atmospheric air developed normally, and that specimens from the main culture tank from which these had been removed a few days previously gave the usual results on submersion in aerated water (half dead in 3 hours, one-fourth lived 24 hours, one lived over 48 hours). The reasonable conclusion from this is that usually there is a considerable amount of cutaneous respiration (though not enough to sustain life) but that the cuticle of these specimens had been rendered almost or totally impermeable to oxygen and/or carbon dioxide by the culture medium, presumably the yeast or starch in the yeast cake. From this it follows that variation in suffocation time may be due not only to individual differences in tolerance but also to the variable permeabilities of the cuticles of different specimens, and that this variability is influenced by culture conditions.

Serial sections were not prepared from larvae suffocated in aerated water but partially smashed whole-mounts of brains and suboesophageal ganglia were made of several. All slides showed chromatin clumping in the nuclei (table 2).

Suffocation by submersion in aerated water covered with non-toxic oils.—When larvae are killed in water covered with a non-toxic oil typical suffocation figures result. Most of these experiments were run with paraffin oil but a few were run using various grades of highly refined lubricating oils (" Sunoco ").

Suffocation by submergence in various oils.—See under following sections.

TABLE II. Summary of certain data from several experiments showing relative survival, suffocation (chromatin clumping) and degeneration of the central nervous system.

Larvae submerged in	Time to death		Suffocation effect		Cell Separation		Fiber degeneration	
	Time	Number examined	Degree	Number examined	Degree	Number examined	Degree	Number examined
1. Water minus oxygen, premortem	70 min.	100+	xxxxx	6	0	6	0	6
2. Water minus oxygen, postmortem.	70 min.	100+	xxxxx	7	0 to xxxxx*	7	0 to xxxxx*	7
3. Aerated water, premortem.......	3–80 hrs.	100+	xxxx	6	—	—	—	—
4. Aerated water plus layer of paraffin oil, premortem.............	4–32 hrs.	21	xxxx	2	0	2	0	2
5. Blotted and immersed in paraffin oil.........................	Various, see Table III				—	—	—	—
6. Aerated water plus layer of No. 1 fuel oil......................	½–1½ hrs.†	29	xxxx	9	xxxxx	5	xxxx	5
7. Blotted and immersed in No. 1 fuel oil......................	½–1¼ hrs.	12	x	9	—	—	—	—
8. Aerated water plus layer of No. 2 fuel oil......................	¾–1½ hrs.	24	xxx	4	xxx	4	xx	4
9. Blotted and immersed in No. 2 fuel oil......................	¾–1¾ hrs.	8	x	8	xx	2	xx	2
10. Aerated water plus layer of No. 4 fuel oil......................	¾–2½ hrs.	25	xxxx	5	xxx	5	xxx	5
11. Blotted and immersed in No. 4 fuel oil......................	1¾–2½ hrs.	14	x	14	xxxx	2	xxxx	2
12. Controls.....................	—	—	0	32	0	21	0	21

0 = no effect, i.e:, like controls.
x = effect in only some parts of some specimens and none or almost none in other specimens.
xx = effect in some parts of all specimens.
xxx = moderate effect in all specimens, usually not uniform throughout.
xxxx = considerable effect in all specimens and more or less in all parts.
xxxxx = most extreme and most general effect.

* Depends on length of time since death.

† One exceptional specimen survived 3½ hours.

EFFECTS OF TOXIC OILS

Toxic effect without suffocation effect.—(Table II.) This was not obtained with complete consistency but was obtained partially in a number of slides and completely in a few. Partial absence of the suffocation effect (chromatin clumping) was obtained in some of the experiments in which larvae were imprisoned in aerated water under a cover glass surrounded with a ring of oil. Complete absence of the chromatin clumping was obtained only in larvae which were blotted, air-dried for a few minutes and then immersed in a film of oil. The question of respiration will be taken up in the next section.

The histological effect of a toxic oil is very different from that of asphyxiation (figs. 8–12). In premortem specimens in which the heart is still beating weakly, or in which the heart has stopped beating but the specimens still show skin twitches, the cells of the central nervous system become separated from one another, the cell layer becomes clearly separated from the fiber tract region, and the nerve fibers and fiber tracts undergo degeneration. The degree to which this proceeds depends on the oil used (more extreme as a rule with more volatile oils), the nearness of death, and doubtless on dosage. The most extreme degree was found in the brains of specimens treated with kerosene (No. 1 fuel oil) and at about the time of death. In these the degree of degeneration was comparable to that shown by twelve-hour postmortem suffocation figures (fig. 13) but the fiber tract was relatively more degenerate and chromatolysis relatively slight. It would seem that such a nervous system could not be functional and may be dead, the visible reactions of peripheral parts being independent of stimulation from the central nervous system.

It may also be noted that this effect is not expressed to a uniform degree throughout the entire nervous system but tends to be more extreme in the brain and suboesophageal ganglion. As the oil entering principally by the spiracles reaches the more posterior ganglia first this may indicate a greater susceptibility of the anterior end of the nerve cord (compare Hartzell & Wilcoxon, 1932, and Richards, 1937). No detailed study of this has been made as yet since all that is being sought here is a clear distinction between toxic and suffocation effects.

With the use of a fixing fluid that is so strong a dehydrating agent as 95% alcohol plus acetic acid, some shrinkage of cells occurs because of the fixative. This frequently leads to a slight uniform separation of the cells in normal and control animals. This shinkage, however, does not give the same appearance as the irregular separation due to toxic oils, does not cause a separation of the cell layer from the fiber tract, and is never accompanied by fiber degeneration.

To casual inspection the other tissues appear histologically normal. The fat bodies were noted in particular and appeared normal in premortem specimens both in the usual histological preparations in which fats are removed during preparation and in formalin-fixed frozen sections stained with Sudan IV. After death the fat body rapidly discolors (macroscopic observation) and soon begins to disintegrate.

The number of specimens examined in serial section after immersion in No. 2 and No. 4 fuel oils is too low to be significant when taken alone. Taken in conjunction with those in No. 1 fuel oil and in paraffin oil they furnish added proof that suffocation has occurred. Destruction of nervous tissue occurred in all specimens treated with these volatile oils; this agreement makes more acceptable the data from each individual oil.

Although consistency was not reached in obtaining slides entirely free of suffocation effects, the several obtained suffice to prove the presumption that chromatin clumping in these experiments was a product of asphyxiation and not produced by direct action of the oils.[4]

Toxic effect plus suffocation effect.—(Table II.) As mentioned above, both effects are usually found (compare figs. 8–9 with figs. 10–12). In all experiments approaching field conditions both effects appear. At first it was thought that suffocation accelerated the death of the larvae but further tests showed enough variation to suggest that there is no significant difference between larvae in water in good contact with No. 1 or No. 2 fuel oil and those immersed in these oils. With No. 4 fuel oil the average death is somewhat slower, and those immersed in this oil and showing little or no suffocation effect at the time of death live somewhat longer than those in water in constant contact with the oil. This last has no economic significance but does have a bearing on cutaneous respiration (see next section).

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[4] Larvae without chromatin clumping were commonly obtained after immersion in paraffin oil. See section on Respiration in Oil.

When only partial asphyxiation (as expressed by chromatin clumping) is obtained with oils it is much more apparent in the nervous system than elsewhere. Within the nervous system the degree also varies, for instance the cells of the optic lobe show clear chromatin clumping only under extreme asphyxiation (i.e., when all other nerve cells also show clumping), while the more posterior parts of the brain and the suboesophageal ganglion show clumping most commonly.

RESPIRATION OF MOSQUITO LARVAE IN OIL

The proof that respiration occurs in oil is only indirect, no quantitative measurements of respiration in oil having been made so far as I know. However, the data summarized in table III seem none the less conclusive. In paraffin oil of low oxygen content larvae die in approximately the same time as in non-aerated water and show the highest degree of suffocation effects. Controls showed no chromatin clumping. Specimens in aerated oil lived much longer; in one experiment some larvae were still active after sixteen and one-half hours immersion and showed no chromatin clumping. Asphyxiation as expressed by chromatin clumping in the brain and suboesophageal ganglion varied. When the cuticle was wet asphyxiation occurred rapidly and chromatin clumping was considerable or extreme (table III, no. 2); when the cuticle was dry survival was longer and chromatin clumping less or absent in all cases except one. This experiment was repeated in part several times with similar results.

The solubility of oxygen in a mineral oil similar to paraffin oil has been shown by Kubie (1927) to be about four and one-half times as great as in distilled water at the same temperature, and the solubility of carbon dioxide to be slightly higher than in water (1.0922 times). But Kubie also shows that the diffusion of carbon dioxide in oil and from oil to air is slow, and presumably this would be true of oxygen also.[5]

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[5] As far back as 1911 Shafer demonstrated that both oxygen and carbon dioxide can pass through kerosene films.

TABLE III. Survival and asphyxiation of larvae immersed in paraffin oil. All data from one experiment. All specimens, except No. 1, scattered over bottom of petri dishes to preclude crowding as a factor. Temperature during experiment 14–16° C. Time expressed in hours. Degree of chromatin clumping expressed as in table 2. Histological examination of only brains and suboesophageal ganglia. Experiments No. 39A–J.

Conditions of experiment	Number of specimens used	Mortality data					Histological examination	
		1st death	50% dead	All dead	End of expt. (hours)	Condition of specimens at end of expt.	Degree of clumping	Number examined
1. In boiled and cooled oil at bottom of 3 inch vial	12	$1\frac{1}{4}$	$1\frac{1}{3}$	less than 2	2	All dead	xxxxx	6
2. Each spm. in separate small drop of water covered with approx. 6 mm. of oil	12	2	$2\frac{1}{2}$	—	$3\frac{1}{4}$	9 dead, 3 with heart weak and barely capable of movement in fixative	xxxx	10
3. Each specimen blotted and covered with approx. 6 mm. of oil	12	$1\frac{5}{6}$	3	$8\frac{2}{3}$+	$8\frac{2}{3}$	11 dead, 1 with weak heart-beat	x	9*
4. Each specimen blotted and covered with approx. 2 mm. of oil	12	$6\frac{1}{2}$	—	—	$9\frac{3}{4}$	1 dead, 9 unresponsive and with heart weak, 2 active	xx	9 (living)
5. Each specimen blotted and covered with thin film of oil	12	—	—	—	$9\frac{1}{3}$	All with weak heart-beat	xxxx	6 (living)
6. Each specimen blotted and air-dried for 15 min.; then covered with 2 mm. of oil	12	4	—	—	$8\frac{1}{3}$	3 dead, 9 with weak heart-beat	xx	7 (living)
7. Same as last but dried in air for 30 min.	4	$6\frac{1}{2}$	7	—	$8\frac{3}{4}$	2 dead, 1 nearly dead, 1 weak but active	—	0
8. Same as No. 4	10	—	—	—	2	All active; 5 fixed after 1 hour, 5 fixed after 2 hours	1 hr. xxx 2 hr. xxx	4 5
9. Controls (normal)	12	—	—	—	—	All appeared normal	0	12

*Only 2 of the 9 examined showed chromatin clumping.

It follows that, cutaneous respiration being accepted as a fact, oil should supply more oxygen to an insect than water does. Gaseous diffusion being slow asphyxiation is still probable at least in many cases. But it does not necessarily follow that death of an insect immersed in such oil is due to suffocation, for active mosquito larvae are restricted as to movement by the high viscosity, are starved and yet engorged with mineral oil which causes extensive intestinal disturbances. And finally, chromatin clumping, which was found invariably present in anaerobic and near-anaerobic conditions was slight or absent in aerated oil but fully developed in oil of low oxygen tension.

The more rapid death of wet larvae immersed in oil was checked several times. Kubie's data deal primarily with the diffusion rates from oil to air; less accurately these data give the diffusion rates within the body of the oil itself. No data are available on the diffusion rates of these gases across an oil-water interface. Attempts to rationalize these data on a basis of solubilities fail because of not knowing whether chromatin clumping and death are both or individually due directly or indirectly to oxygen lack or carbon dioxide excess or both. A wet cuticle introduces new interfaces: oil-cuticle-blood versus oil-water-cuticle-blood,[6] but these interface differences cannot account for the great differences observed for gaseous diffusion in wet versus dry larvae immersed in oil. Interfacial tensions are also certainly different but could scarcely be a major factor. Yet such a film of water is of great importance in that it produces prompt asphyxiation. This is proven by 1) the length of survival being approximately the same as for larvae under known near-anaerobic conditions, and 2) the presence of extreme and extensive chromatin clumping which is produced by asphyxiation but is not directly produced by the oil. It is obvious that wetting or possibly removal of the waxy epicuticle by the oil is an important factor in respiration in oil, but I am not prepared to state why this is true.

The discrepancies in chromatin clumping in table III led to a test to see if chromatin clumping remained constant or changed during different stages preceding death. Number 8 of table III was originally intended for this but seemed inadequate. Seventeen larvae were scattered in a thin film of aerated paraffin oil on the bottom of a petri dish, and specimens were removed for histological examination after two, three and three-quarter, five and one-half, nine and twelve and three-quarter hours. Dead and lethargic specimens were segregated from active specimens. All showed slight chromatin clumping but there was no appreciable difference between active and nearly dead specimens or between specimens removed at different times, and the two specimens still active at the end of the experiment showed only barely detectable evidences of chromatin clumping. Table II, nos. 3 and 4 (and also 6, 8 and 10) also corroborate the idea that the chromatin clumping is not prevented by slow asphyxiation. These experiments indicate that whatever causes the discrepancies in chromatin clumping in table III, it is probably not the length of exposure or the nearness of death, and that chromatin clumping is not prevented by slow asphyxiation.

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[6] Hurst (1940) has recently emphasized the importance of the cuticle-blood interface, but these data are not comparable.

A check on survival using the more highly refined mineral oil "Nujol" gave entirely similar results.

A few insects are known to be able to spend part of their life immersed in oil. The classical example is the Petroleum Fly, *Helaeomyia petrolei* (Coquillett),[7] the larvae of which breed only in open oil pools in California (Thorpe, 1930, 1932). Recently Mrs. A. R. Whiting (1940) and others have used the mineral oil "Nujol" as a convenient medium in which to observe the development of embryos in insect eggs. Mrs. Whiting has reared thousands of embryos of the parasitic wasp, *Habrobracon juglandis* Ashm., thus immersed, observing and recording the degree of development and hatchability. Survival is the same as in eggs allowed to remain on the outside of the host caterpillar (maximum emergence about 85%), and the larvae after hatching survive several days crawling around in the oil with which they become thoroughly engorged. I considered that this must be possible because of adequate exchange of gases with the oil. Several experiments were run to check this,[8] only one of which will be cited. Thirty-nine young eggs of *H. juglandis* were placed in "Nujol" in a depression slide under a sealed cover glass; the volume of the oil was less than 1/20 cc.; none hatched, most died as late blastoderms, a few at early germ band stages but this slight difference could be accounted for by differences in age of the eggs at the start of the experiment. Controls under a film of oil exposed to air gave normal hatching percentages. From this it follows that the observed normal development of these embryos in oil depends on exchange of respiratory gases with the oil.

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[7] Order Diptera, family Ephydridae, originally described as of the genus *Psilopa*.

[8] Thanks are due Mrs. Whiting for supplying the author with this material.

Heavy oils are commonly used as ovicides, the presumption usually being made that they cause suffocation. O'Kane *et al.* (1934, 1935, 1940) were the first to question this assumption; they demonstrated penetration of the oils through the egg shell and cuticle, and suggest that the contact action of these on the protoplasm causes death. In some cases this penetration is reported not to occur (see Powers & Headlee, 1939) and no explanation of death is yet proven. Reviews of this literature and other papers are given by Shepard (1939) and Hoskins (1940). No claim is made here as to the cause of death of mosquito larvae immersed in paraffin oil; all that is claimed is that considerable respiration occurs and that the histological evidence does not support the idea that they die from asphyxiation.

DISCUSSION

Critique of these studies on oil effects.—The foremost objection to these studies is the virtual ignorance of dosages. One reads that oil on water pours into and rapidly fills all the tracheae. This does happen commonly especially when the larva remains with its siphon open at the oil-water interface. Under this condition even the heaviest lubricating oils enter. But it is also common for the larva not to remain at this interface. In this case the valves of the respiratory siphon remain closed if in water and may be closed or open if in the oil layer. Checks using various oils stained with Sudan IV showed considerable differences in the amount of oil entering (from near zero to filled tracheae). Wigglesworth (1930) reports that the oil is drawn into the tracheae by negative pressure due to the absorption of all gases from them, but there is another possibility especially for the large tracheal trunks that feed the smaller branches, namely collapse. This is easily possible from their structure in *Culex* larvae, and it happens quite commonly as has been observed both in intact larvae and in serial sections. Air is removed from the tracheae, as was first pointed out by Koch (1920), but it is not necessarily replaced by oil.

There is also probably always a difference in dosage between specimens immersed in oil and specimens in water covered with oil. In addition to the possible effect through the general cuticle on immersion, the valves of the respiratory siphon usually remain open when immersed in oil and the tracheae promptly become filled. This is commonly not true with specimens in water covered with oil.

These objections invalidate the data presented here in so far as portraying the true toxicities, i.e. either amount of oil needed to kill or time for a given amount to kill. However, this practical point is not the thesis of this paper, and the objection does not invalidate the distinction made between suffocation and toxic effects.

In this connection it may be noted that data from several developmental stages of last instar larvae have been grouped together in this discussion. Developmental ages were recorded in the experiments and the degree of development of the imaginal discs can be checked in the slides, but separation is not made in this paper as the histological pictures are alike throughout this instar until middle or late prepupae. In late prepupae the histological effects become rather obscured in the metamorphosing tissues and tolerance of the individuals to experimentation drops. Late prepupae have been eliminated and the other ages considered together.

In addition to premortem specimens and specimens at about the time of death, I have a number of slides of postmortem larvae killed with oil. These show the same effects but are more extreme. They (e.g. ½ hour postmortem) also show noticeable chromatolysis which is not evident in slides of premortem larvae. This leads to the separate observation that death as expressed by heartbeat and skin twitches is not closely correlated with the exact degree of degeneration of the central nervous system. It would seem probable that this would depend on both dosage and time of exposure but direct demonstration of this was not obtained.

One can distinguish between paralysis of the central nervous system and of those peripheral parts that are more or less automatous. This is shown for instance by paralyzed prey of parasitic Hymenoptera. This is an inherent difficulty in studying the central nervous system and using as criteria of death phenomena not entirely dependent thereon. Unfortunately one cannot readily test reflexes in experiments with mosquito larvae. As a substitute it might have been better to have used cessation of the swallowing reflex. With this, however, it is not possible to say just when cessation occurs without observing for a considerable period after it has stopped—in other words it is not possible to get specimens known to be at the time of cessation.

To a certain degree this truly serious criticism can be answered. If the swallowing reflex be used as criterion the result would be to reduce greatly the histo-pathological *premortem* destruction of the nervous system (compare Kruger, 1931). Such a viewpoint, in effect, makes any marked degeneration of the nervous system " postmortem "—a viewpoint that has some advantages even though the heart is still beating and muscles can contract. But such a viewpoint is certainly not entirely correct even though paralysis is complete. There is no histological method of showing when a cell ceases to function or dies. There is, however, one point which shows conclusively that larvae called premortem in this paper are living as that term is usually understood. Larvae were placed directly into the fixing fluid and there opened. Premortem larvae always made feeble or moderate swimming movements, and this was recorded as final confirmation of the other criteria.

One can also object that instead of truly anaerobic conditions I used low oxygen concentrations for suffocation. There is good evidence in this case that such an objection is largely forensic. Fraenkel & Herford (1938) have shown that cutaneous respiration is dependent on the oxygen concentration, and that the amounts of oxygen absorbed under concentrations comparable to those used here are inadequate even for the aerial respiration of normally air-breathing forms. And finally, Buck & Boche (1938) obtained the same histological results only somewhat more generally expressed in the total absence of oxygen.

The validity of chromatin clumping as an index of asphyxiation cannot be adequately evaluated until it is better understood. Obviously it is not the primary cause of death, yet under known conditions of suffocation it was found invariably by Buck & Boche (1938) and the present author. Experiments set up to test its validity (table II, nos. 3 & 4 and expt. in text of section on respiration in oil) upheld it. Final evaluation however, must await an explanation of the phenomenon, especially since certain other conditions (not present in these experiments) can also cause clumping of chromatin (see Buck & Boche, 1938).

These data pertain only to petroleum oils and as the experiments were performed pertain only to such oils entering primarily via the tracheal system. These effects are not necessarily the same as the effects of other substances called oils, e.g. terpenes, camphors, creosols, etc., on which preliminary experiments have also been made. And most certainly, although the recorded effects are different (technique also different) they are not to be considered as conflicting with the studies on the effects of pyrethrum, rotenone, nicotine, etc. recorded by Hartzell, Wilcoxon, Klinger, Krüger, McIndoo and others (for resumé of these papers see Hoskins, 1940).

Cutaneous respiration.—The survival of submerged larvae in aerated water must be due to cutaneous respiration as has been pointed out numerous times. In a recent paper Fraenkel & Herford (1938) measured respiration with Dixon's modification of the Barcroft manometer. These authors determined oxygen consumption, carbon dioxide production and the respiratory quotient for normal blow-fly larvae, paralyzed larvae and larvae in which the spiracles were ligatured. Measurements were made at various oxygen concentrations and in aerated and oxygenated water. Oxygen absorption through the skin alone (when tracheae ligatured) was found to be about one-quarter the basal rate (⅛ the active rate) with a R. Q. of 1.34 indicating considerable anaerobic metabolism. For normal aerial respiration calculations gave an estimate of one-tenth the oxygen uptake occurring through the skin. On submergence in water the spiracles were shown not to function and oxygen uptake to be wholly dependent on oxygen tension, this uptake being slightly lower than the uptake in a pure oxygen atmosphere. Using larvae of *Culex* sp. they showed the oxygen uptake of larvae submerged in water saturated with oxygen to be about one-half the normal uptake of active larvae allowed access to atmospheric air (oxygen uptake should be much less in aerated water). They thus demonstrate that cutaneous respiration plays a role in normal insect respiration, that it depends on differences in oxygen concentration, that it increases when tracheal respiration is blocked, and that some anaerobic respiration is possible.

Comparison of these exact data with the variable data presented here is difficult. Fraenkel & Herford avoid discrepancies due to using different individuals by making both the normal and experimental measurements on the same individuals. Also their animals were at no time during the experiments anywhere near death; nor were they subjected to changing gaseous tensions. On the other hand, the experiments reported in this paper approach more closely to field conditions of oil insecticide usage.

Fraenkel & Herford's data show that oxygen uptake in water depends on the oxygen concentration. It also depends on other factors since the four species used obtained different fractions of their normal uptake. One of these factors is probably size since one-half the normal volume of oxygen absorbed by active larvae is absorbed through the skin of *Culex* larvae, one-fifth by *Tenebrio* larvae, one-eighth by *Calliphora* larvae, and one-fifth by isolated ligatured segments of the caterpillar of *Chaerocampa.*[9] There also must be a difference in the permeability of the cuticle of different species, direct evidence being supplied by Morgan & O'Neil (1931) and Morgan & Grierson (1932) who show with quantitative measurements that caddis-fly larvae with gills removed respire normally while may-fly nymphs without gills respire at only about half the normal rate—this reduced rate being adequate in the winter but not in the summer. Another factor is shown in the present paper, namely variable permeability of the cuticle within one species.

Koch (1920) observed that the oxygen concentration of the water in which *Culex* larvae were submerged was " not approximately proportional " to the production of mechanical energy as measured by movements. In the present paper it is shown not to be directly proportional to survival or consumption. Koch lays great stress on the carbon dioxide tension and points out that excess of carbon dioxide leads to lethargy and death about three times as rapidly as a lack of oxygen. While many of the carbon dioxide tensions he used were abnormally high, effects were also observed at reasonable concentrations.

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[9] In a sense the large caterpillar of *Chaerocampa* is an exception. Size is not the only factor and this example may be due to extra high permeability of the cuticle. One may question, however, the normality of isolated segments of a larva (ligatured and severed).

In conclusion it may be said that survival on submersion depends on cutaneous respiration which in turn depends on at least seven factors: (1) oxygen concentration, (2) carbon dioxide concentration, (3) temperature, (4) activity, (5) inherent differences in permeability between the cuticles of different species, (6) environmentally produced differences in cuticle permeability within a single species, and (7) size of the insect. Fraenkel & Herford demonstrate clearly the fallacy of the common idea that submersion in water automatically subjects an air-breathing insect to anaerobic conditions. This is less conclusively demonstrated in this paper and by others cited in the introductory section on literature. Asphyxiation certainly is retarded by cutaneous respiration and in some cases may be almost or completely prevented (may-fly nymphs and caddis-fly larvae with gills removed, larvae of *Aedes aegypti*, *Donacia* spp., etc.), but the interrelations of oxygen and carbon dioxide concentrations and the physiological cause of the chromatin clumping which is shown to be a good criterion of asphyxiation need elucidation.

Cutaneous respiration in oil is herein definitely shown to be a fact. Much more oxygen is dissolved in a given quantity of oil than in the same amount of water, and the respiration in the oil is enough to prevent the appearance of the histological criterion of asphyxiation in dry mosquito larvae and enough to support the respiration of *Habrobracon* eggs and the larvae of the Petroleum Fly. To the list of seven factors conditioning cutaneous respiration in water an eighth may be added for such respiration in oil, namely contact of the oil directly with the cuticle in contrast to separation from the cuticle by a film of water. It is concluded that dry *Culex* larvae immersed in oil do not die primarily from asphyxiation although wet larvae do.

General remarks.—Histological effects are not necessarily portraits of the cause of death. This is well shown by suffocation series where the visible effects are fully reversible up to the time of death (Buck & Boche, 1938) and are the same immediately before and after death. In connection with insecticide studies, histopathology is certainly not an end in itself. Histology is only a way of detecting what tissues are visibly affected and a criterion that is sometimes useful in checking physiological experiments. With some toxins (insecticides) the histological effects preceding death are so extensive it would seem that they must picture at least a part of the important effect of the poison. This is particularly true of substances that cause extensive degeneration of nerve cells and their processes.

The difficulty as to just when an organism dies can never be fully resolved. But, in distinction to the custom of some students, it certainly seems to me necessary to use premortem individuals in histopathological searches for parts affected by toxins. This does not entirely invalidate the use of postmortem individuals particularly for diagnostic purposes, but obviously it is essential to know the state of each specimen. And if the specimen is postmortem it is necessary to know how long it has been dead (as determined by some concrete criterion), and to make comparisons not to normal histology but to the histology of untreated specimens that have been dead for the same length of time.

It is rather surprising that no extensive premortem changes were demonstrated in the chromidial picture. However, Scarborough (1938) noted no fatigue changes in cells of sympathetic ganglia of vertebrates though such are well known in the central nervous system of vertebrates (see Weil, 1933 or other neurology textbooks). In the classification of vertebrate nerve lesions given by Weil, the effects of toxic petroleum oils on the mosquito nervous system seem most similar to his " severe ganglion disease or cell liquefaction " which involves dissolution of the cytoplasm with the formation of pale ring-like granules, loss of neurofibrils, nuclei with dark granules and nucleolus eccentric, and has as its end stage dissolution of the cell. This is caused by acute infections and intoxications. Obviously this does not agree perfectly with the description and figures given in this paper but it comes closer than other types of lesions listed by Weil and other authors.

Even if chromatin clumping is fully substantiated as a criterion of asphyxiation by subsequent work, proof of suffocation will still be difficult to obtain in the presence of complicating factors. Chromatin clumping can be caused by certain conditions other than suffocation, and these conditions may sometimes be difficult to circumvent. But certainly negative results in an attempt to show direct effects of oils are not a proof of asphyxiation. Neither is it a proof of suffocation to show that anaerobic conditions cause death and that oils also cause death (Powers & Headlee, 1939).

It is improbable, to say the least, that oils simply diffuse into an insect's body cavity "dissolving first the fat bodies and finally the entire cellular structure of the body" (de Ong, 1926). After death the visible change in color of the fat body is commonly the first noticeable change in a transparent insect but this does not necessarily mean that it is the first tissue affected, or that it is affected prior to death, or even that it is affected by the insecticide at all. Histological sections are needed and even they, of course, can show only visible cellular changes.

In addition to the recent literature showing that an oil-block in the tracheae does not necessarily result in asphyxiation, and that oil films and immersion in oil do not prevent the exchange of respiratory gases, it may be added anent the literature that the more rapid death of an air-breathing insect immersed in water than in an oil does not prove that the oil only suffocates (de Ong, Knight & Chamberlin, 1927), and that an oil film on water does not by its low surface tension prevent a mosquito larva from remaining at the surface and so cause it to drown (Findlay, 1927); soap solutions with the lowered surface tensions they produce have been said to wet the spiracles of anopheline larvae and so kill (Hacker, 1925) but these do not kill larvae of *Culex pipiens* which can remain at the surface in the presence of an oil film and can breed in soapy laundry tubs and laundry effluents (Richards, 1938 and earlier field workers).

SUMMARY

1. On submersion in water of low oxygen content larvae of *Culex pipiens* die in approximately seventy minutes. In water in equilibrium with air they may live for long periods. Living submerged in aerated water depends on cutaneous respiration as already shown by others.

2. Cutaneous respiration in insects has been shown by Fraenkel & Herford to depend on oxygen concentration, by Koch to depend on carbon dioxide concentration and by Morgan & Grierson and others to depend on temperature and activity. In this paper it is

pointed out that it probably also depends on size and certainly on the degree of permeability of the cuticle. Even within one species (*C. pipiens*) culture conditions may render a normally permeable cuticle almost or quite impermeable to respiratory gases.

3. Asphyxiation produces chromatin clumping in the nuclei of *Culex* larvae, especially nuclei of the central nervous system. This clumping is not the cause of death but is a criterion of asphyxiation.

4. Toxic (volatile) petroleum oils do not necessarily cause any suffocation. They do cause extensive degeneration of nervous tissue as shown by premortem cell separation and degeneration of nerve processes and fiber tracts.

5. As normally applied in mosquito control, all oils, toxic or non-toxic, lead to histologically demonstrable suffocation effects (chromatin clumping). With the extremely toxic oils this does not materially alter the time needed to kill; with less toxic oils the results are rather variable but a mean acceleration of killing time is imposed when asphyxiation is also a factor.

6. Larvae of *Culex pipiens* immersed in aerated paraffin oil respire. When the cuticle is dried before immersion the respiratory exchanges are commonly sufficient to lengthen life up to more than ten times the length under near-anaerobic conditions and to prevent or greatly lessen the clumping of chromatin. When the cuticle is wet death follows rather promptly and chromatin clumping is extreme; from this it is concluded that such larvae are asphyxiated. Checks showed that slow suffocation does not prevent chromatin clumping and that non-aerated oil produced prompt death and extensive clumping (i.e. asphyxiation). It follows that larvae of *Culex pipiens* air-dried and immersed in aerated paraffin oil probably do not die from asphyxiation, and that adequate cutaneous respiration depends on direct contact between the oil and the cuticle of the larva.

7. A critique of the experiments is given. Also a summary and discussion is presented covering the literature on the suffocation of mosquito larvae, and of cutaneous respiration in insects with particular reference to such respiration in water and in oil. And finally brief notes are presented concerning histopathological and similar studies with insects.

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EXPLANATION OF FIGURES

Photomicrographs taken with 8 × ocular and 95 ×, 1.8 mm. achromatic oil-immersion objective using process plates and a yellow-brown filter. All sections cut serially at 5 microns and stained with toluidine blue.

Plate XIV:

The line scales beneath each figure represent 50 microns

Fig. 1.—Normal (control for oil experiments, figs. 9–12), No. 32C6. Ventral and median parts of a section through the anterior part of the second thoracic ganglion. Enlargements in figs. 14 and 20. Magnification 400 ×.

Fig. 2.—Normal, No. 32C6. Ventral and lateral parts of a section through approximately the center of the first thoracic ganglion. Enlargements in figs. 15 and 21. Magnification 400 ×.

Fig. 3.—Normal, No. 32C6. Small portion of brain (protocerebrum); optic lobe to the left, center of brain to the right; the clear circle near the center and the tube leading up from it are tracheae. Enlargements in figs. 16 and 22. Magnification 400 ×.

Fig. 4.—Suffocation experiment, premortem, No. 31J6. (Submerged for 35 min., lethargic but moving feebly.) Left half of section through anterior part of suboesophageal ganglion. Enlargements in figs. 19 and 25. Magnification 600 ×.

Fig. 5.—Suffocation experiment, premortem, No. 31J6. Central portion of section through posterior part of second thoracic ganglion. Enlargements in figs. 18 and 24. Magnification 600 ×.

Fig. 6.—Suffocation experiment, premortem, No. 31J2. (Submerged for 35 min., lethargic but moving feebly.) Left quarter of section through suboesophageal ganglion. Enlargements in figs. 17 and 23. Magnification 600 ×.

Fig. 7.—Suffocation experiment, premortem, No. 31J2. Part of section through right side of suboesophageal ganglion. Magnification 600 ×.

Plate XV

The line scale at the bottom represents 100 microns, the divisions each 25 microns

Fig. 8.—Experiment with No. 2 fuel oil, No. 33J5. (Immersed in oil for 1¼ hrs., heart beating but not reactive.) Part of brain (protocerebrum), showing cell separation and fiber degeneration but no chromatin clumping. Note characteristic clear line of separation between cell layer and fiber tract. Magnification 512 ×.

Fig. 9.—Experiment with No. 2 fuel oil, No. 33J5. Anterior end of first thoracic ganglion with part of the darkly staining gut above. Beginning of cell separation and fiber degeneration but no chromatin clumping in either nerve cord or gut. Magnification 512 ×.

Fig. 10.—Experiment with No. 2 fuel oil, No. 33J6. (Immersed in oil for 30 min., heart stopped in posterior part of abdomen but still beating in anterior part of abdomen, slightly reactive in fixative.) Part of brain (deutocerebrum) showing in this area no cell separation, and chromatin clumping in the medium-sized cells but not in the large cells (other areas showed cell separation and fiber degeneration). Magnification 512 ×.

Fig. 11.—Experiment with No. 2 fuel oil, No. 33J4. (In water surrounded with oil for 1½ hrs., general twitching and bending in fixative.) Right half of section through anterior part of third thoracic ganglion showing extensive cell separation, moderate fiber degeneration and chromatin clumping in almost every cell. Magnification 512 ×.

Fig. 12.—Experiment with No. 2 fuel oil, No. 33J4. Part of brain (protocerebrum) showing cell separation, fiber degeneration and chromatin clumping. Magnification 512 ×.

Fig. 13.—Suffocation experiment, No. 31F1. (Postmortem approximately 12 hrs.) Part of brain (protocerebrum). This stage in postmortem degeneration comparable with most extreme degree of degeneration found in any premortem larva killed with kerosene (No. 1 fuel oil). No. 2 and No. 4 fuel oils do not cause such drastic premortem degeneration as this. Magnification 512 ×.

PLATES XVI AND XVII

Enlargements (plate XVI) and corresponding drawings (plate XVII) of cells from figures 1–6. Reversed in enlarging and not necessarily placed in same orientation as on plate XIV. Scale beneath each figure represents 10 microns

Figs. 14 and 20.—Normal cell from section shown in figure 1. Surface view of fairly large cell, the nucleus cut away in this section and the visible structures being only the chromidial substance (Nissl bodies) and bases of the cell processes. Magnification 2000 ×.

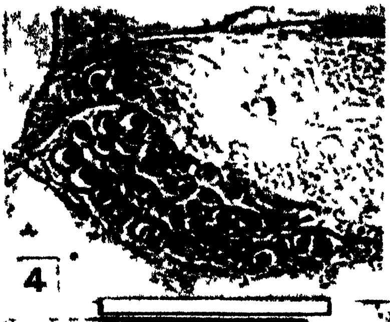
Figs. 15 and 21.—Normal cell from section shown in figure 2. Large cell showing cytoplasm, nucleus, nucleolus and chromatin network. Magnification 1750 ×.

Figs. 16 and 22.—Normal cell from section shown in figure 3. Large cell in protocerebrum with large nucleus but only a thin layer of cytoplasm. Magnification 1600 ×.

Figs. 17 and 23.—Cells showing suffocation effects (chromatin clumping) from section shown in figure 6. Magnification 1800 ×.

Figs. 18 and 24.—Cells showing suffocation effects from section shown in figure 5. Cell on right cut through nucleus and nucleolus, cell on left with nucleus cut off and showing only cytoplasm in surface view. Magnification 1900 ×.

Figs. 19 and 25.—Cells showing suffocation effects from section shown in figure 4. Magnification 2300 ×.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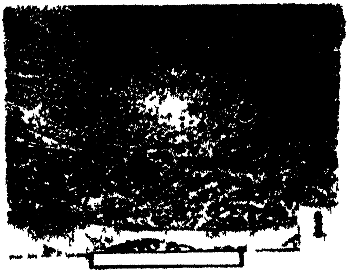
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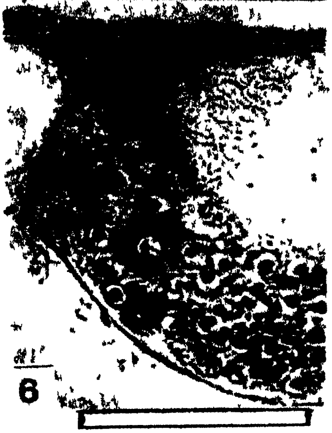
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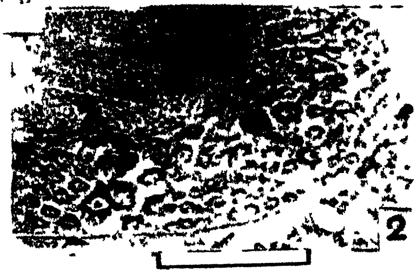
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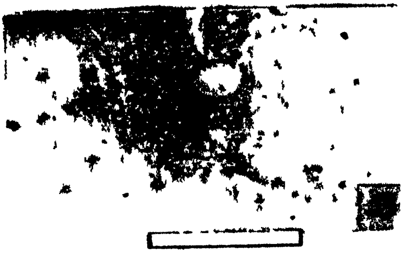

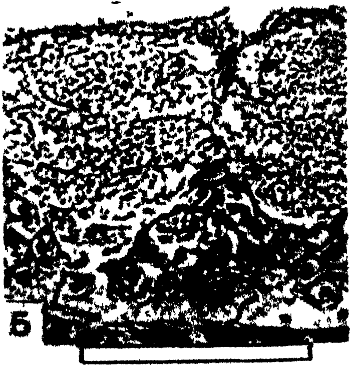
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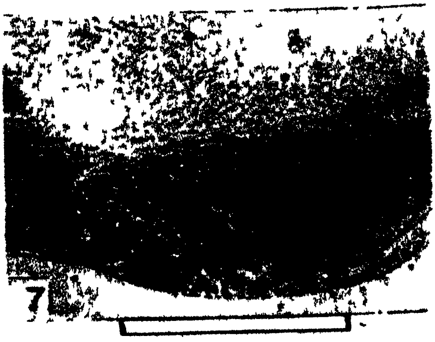
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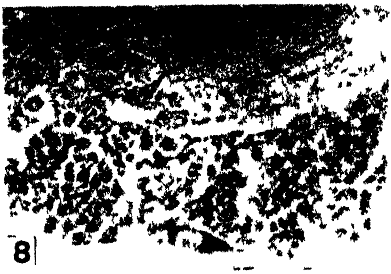
RICHARDS—EFFECTS OF OILS ON MOSQUITO LARVAE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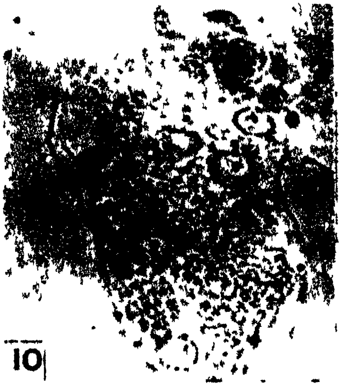
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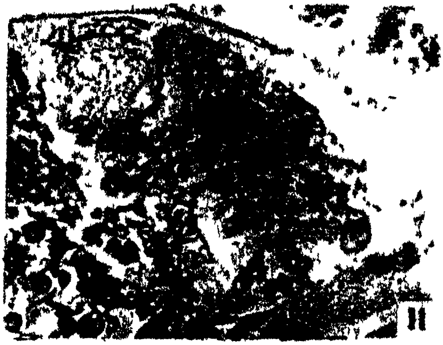
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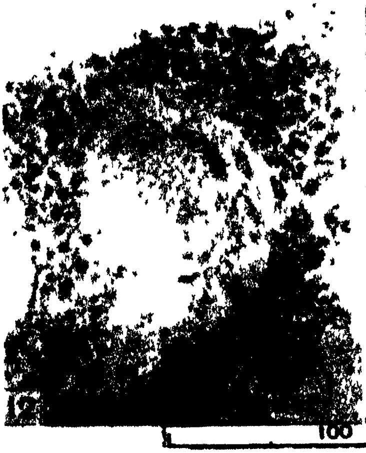
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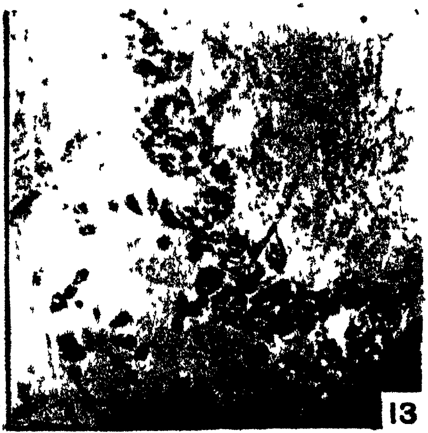
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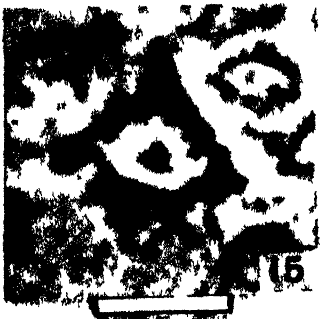
RICHARDS—EFFECTS OF OILS ON MOSQUITO LARVAE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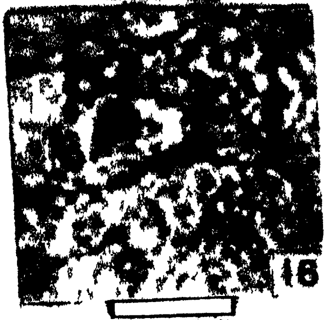
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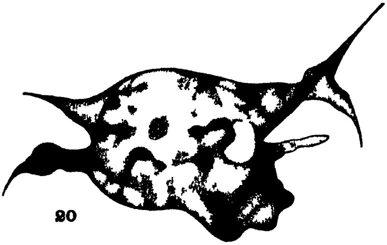
RICHARDS—EFFECTS OF OILS ON MOSQUITO LARVAE



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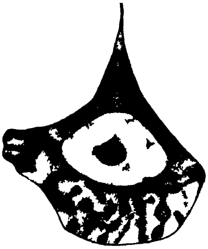

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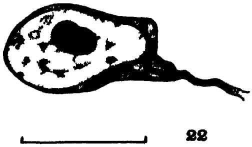

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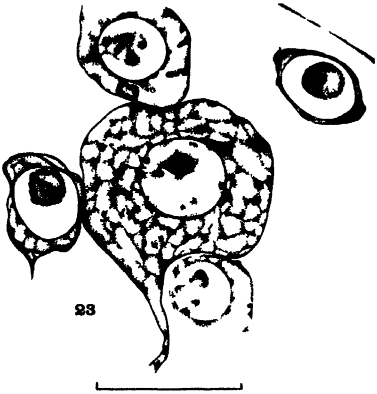

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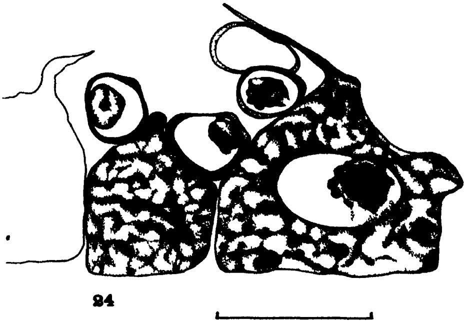

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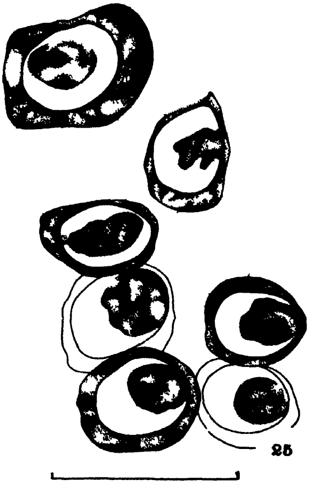

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RICHARDS—EFFECTS OF OILS ON MOSQUITO LARVAE

I A R I

THE GROUP PTEROPHYLLAE AS FOUND IN THE UNITED STATES

(TETTIGONIIDAE: PSEUDOPHYLLINAE)

BY MORGAN HEBARD

Research Fellow, The Academy of Natural Sciences of Philadelphia

(Plates XVIII and XIX)

The Pterophyllae form a particularly interesting group of Katydids in the United States, where in the East they are found north to central New England, southern Ontario, southern Michigan, and northern Illinois, westward into eastern Iowa, central eastern Kansas, eastern Oklahoma and central northern and southwestern Texas. Three distinctive (and two as yet undescribed) species have recently been discovered in northeastern, central eastern and southwestern Mexico.[1]

All are large and handsome insects which, at first consideration, would appear to include strikingly distinct genera, species and races. Such is however not the case. They actually form a plastic entity, with different recognizable branches and subdivisions so complicated that the exact number which should be recognized by name is arbitrary and certainly will remain so until all the variation which occurs can be elaborately analyzed from much more material from certain regions, and certain breeding experiments can be accomplished.

Thus, of the three genera here discussed, both *Paracyrtophyllus* and *Lea,* might almost as justly be reduced to subgenera; while of the five species, the two races here recognized as constituting *Pterophylla furcata* may eventually prove to represent the two ex-

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[1] I have seen no material of *Cyrtophyllus crepitans* Redtenbacher, described from St. Vincent in 1892, or of *Thliboscelus camellifolia* Serville (not *Locusta camellifolia* Fabricius 1775), described from Brazil in 1839, which Caudell renamed *Pterophylla brasiliensis* in 1911. These species were referred to *Thliboscelus* by Kirby in 1906 and to *Pterophylla* by Caudell in 1911 (Ent. News, XXII, p. 167). Their correct generic position cannot at present be determined

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treme developments reached in *Pterophylla camellifolia* along one of its lines of racial differentiation. Finally, though incipient racial differentiation is definitely indicated in the northern, southern and southwestern portions of the range of *camellifolia,* additional to the Gulf Coast and southwestern Arkansas races here discussed, I feel that further nominal recognition is unwarranted even though the average specimen from those regions shows certain surprising differences.

All of the species are strictly arboreal except the races of *Lea floridensis,* which prefer palmettos and underbrush and much less often climb up into lofty trees. As the eastern *Pterophylla* is dependent on deciduous trees, its distribution is often discontinuous but that of *Paracyrtophyllus* in central and western Texas is naturally much more so, where oak areas are often very widely separated or confined to a zone in the mountains dotted with such trees only.

The nocturnal and comparatively sedentary habits of all result in these insects being usually rare in collections, as individuals are very seldom happened upon and can only on special occasions be taken one by one by special effort. I have often heard the night air simply ringing with their song in the lofty river forests of the southeast, all of the singers being virtually inaccessible in the treetops well over 100 feet above. The song of all five species is probably distinctive.

The group Pterophyllae, recognized by Brunner in 1895 as the Cyrtophylli, is distinguished by the following features.

Size large, body bulky. General color green (with the exception of *Lea floridensis* which in both races occasionally develops a light pinkish brown color phase and two undescribed Mexican species which are very distinctively colored). Antennae slender, with bases not contiguous. Tegmina coriaceous, not extremely broad, with surface definitely convex, and lateral margins broadly convex. Tegmina of male with stridulating field very strongly impressed and tympanum transparent. Wings cycloidal, hyaline. Prosternum with two elongate spines. Mesosternum and metasternum acutely produced. Mesosternum with cephalic margin obtuse, not cingulate; sulci, which rise from the foveolae, cruciate. Metasternal foveolae confluent.

1. Pronotum only slightly constricted, subsellate. General color light green[2] with face and underparts paler.........................*2*

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[2] Except in *Lea,* where a light pinkish brown color phase is occasionally developed. Green specimens, however, become light yellow-brown when discolored by alcohol.

Pronotum conspicuously constricted, strongly sellate, substrangulate. General color blackish, purplish, and chestnut brown. (To this section belong two recently discovered and highly distinctive Mexican species, the description of which should appear in the near future.)

2. Caudal margin of pronotum very broadly convex (truncate to subtruncate). (Male cercus lacking a lobe between its dorsal and ventral arms; subgenital plate showing no meso-distal broadening in dorsal aspect. Female cercus with a minute inner tooth at apex.)...3

Caudal margin of pronotum less broadly convex, sometimes showing slight angulation..4

3. Head and pronotum larger in proportion to body bulk.[8] Tegmina and limbs very short. Male abdomen with third tergite (counting median segment as first tergite) bearing a large, stout, erect knob (like in *Lea* but heavier); ninth tergite not at all conspicuously inflated, its caudal margin broadly concave; tenth tergite not conspicuously inset, its caudal margin broadly convex above and not strongly defined from supra-anal plate; supra-anal plate with distal margin not emarginate mesad and with lateral portions toothed ventro-laterad; cercus very small for group with base transverse and dorsal longer than ventral arm; elongate subgenital plate showing greatest abbreviation in group. Southcentral Texas.......*Paracyrtophyllus robustus* Caudell

Head and pronotum of more nearly normal size for group. Tegmina and limbs of medium length. Male abdomen with third tergite unspecialized; ninth tergite not at all conspicuously inflated, its caudal margin weakly concave in median portion; tenth tergite not conspicuously inset, its caudal margin even less strongly concave; supra-anal plate with distal margin angulate emarginate mesad and serrate in lateral portions; cercus larger but very small and delicate for group, with dorsal only about half length of ventral arm; elongate subgenital plate exceeded in degree of production only by that of the Mexican *Pterophylla robertsi* Hebard. Chisos Mountains in Big Bend Region of Texas..............*Paracyrtophyllus excelsus* (Rehn and Hebard)

4. Pronotum with lateral lobes longer than deep. Tegmina and limbs elongate for group. Male abdomen with third tergite bearing a large erect process with apex rounded; ninth tergite not at all conspicuously inflated, its caudal margin weakly concave in median portion; tenth tergite not conspicuously inset, its caudal margin even less strongly concave; cercus lacking a lobe between its dorsal and ventral arms, which arms are almost parallel; subgenital plate showing no meso-distal broadening. Female supra-anal plate triangularly produced distad. Female cercus definitely forked at apex..................10

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[8] As females are proportionately heavier than males in the two following species, this feature and that of the degree of truncation of the caudal margin of the pronotum are more pronounced in that sex.

Pronotum with lateral lobes not longer than deep. Tegmina and limbs medium for group. Male abdomen with third tergite bearing a large median triangular elevation, its apex cephalad forming a round prominence; ninth tergite very strikingly inflated, its caudal margin in median portion strongly and extensively concave; tenth tergite very deeply inset beneath ninth, its caudal margin broadly concave above supra-anal plate; cercus with a lobe between its dorsal and ventral arms; subgenital plate elongate with meso-distal broadening conspicuous in dorsal aspect. Female supra-anal plate rounded truncate distad. Female cercus not forked at apex........................5

5. Male supra-anal plate larger, smooth and rounded truncate distad; cercus with lobe moderately wide, arms strongly divergent and ventral arm the longer and lacking a proximo-internal tooth. Female cercus with a minute inner tooth at apex.......................................6

Male supra-anal plate small, smoothly convex distad; cercus with lobe very wide, arms extremely divergent and ventral arm strikingly elongate with a heavy proximo-internal tooth. Female cercus with a minute dorsal tooth at base of slender tapering recurved apex. Sierra Madre Oriental, Mexico...............*Pterophylla robertsi* Hebard

6. Male cercus with ventral arm not forked distad.....................7

Male cercus with ventral arm strikingly forked distad...............9

7. Male cercus with ventral arm curved or bent inward meso-distad, there simple or slightly thickened (plate XVIII, figures 2 to 5).........8

Male cercus with ventral arm bent inward meso-distad, there produced in a small conical projection. Southwestern Arkansas
Pterophylla camellifolia dentifera subsp. n.

8. Male cercus with median lobe projecting very much less than either arm. Eastern United States, west to eastern Kansas
Pterophylla camellifolia camellifolia (Fabricius)

Male cercus with median lobe strongly projecting, extending caudad slightly more than ventral arm. Gulf Coast of Mississippi, probably west to extreme eastern Texas
Pterophylla camellifolia intermedia (Caudell)

9. Male cercus with distal (outer) fork of ventral arm the shorter. Eastern Texas, excepting narrow humid eastern margin
Pterophylla furcata laletica subsp. n.

Male cercus with distal (outer) fork of ventral arm the longer. Southeastern Oklahoma...........*Pterophylla furcata furcata* (Caudell)

10. Size average smaller. Pronotum with constriction moderately indicated; lateral carinae definitely more divergent caudad. and less broadly defined in color. Male cercus with apex of ventral arm simple, slender, acute. Eastern peninsular Florida, south to La Grange.........................*Lea floridensis divergens* Hebard

Size average larger. Pronotum with constriction scarcely indicated; lateral carinae very weakly divergent caudad and usually conspicuously defined in color. Male cercus with immediate chitinized apex of ventral arm blunt and oblique truncate to its internal base, bearing there a minute chitinous node or tooth. Southern peninsular Florida, north to the Indian River..*Lea floridensis floridensis* (Beutenmuller)

In preparing the present study I have been greatly aided by Drs. R. H. Beamer of the University of Kansas, T. H. Hubbell and I. J. Cantrall of the University of Michigan, A. B. Gurney of the National Museum and H. F. Strohecker of Kenyon College.

After two years of complete disability, due to acute arthritis, this is the first revision I have published. Without the constant and exceptionally efficient assistance of Miss Mary E. Chubb, it could not have been accomplished.

A total of 288 specimens has been examined, including all of the three (not strongly defined) genera, five species, and four geographic races here recognized as belonging to the Fauna of the United States. The material is in the author's collection unless otherwise stated.

Much remains to be determined as to the status and the limits of distribution of the species and races which occur on the Gulf Coast from Mississippi to eastern Texas and of those found in southwestern Arkansas, southeastern Oklahoma, northwestern Louisiana and northeastern Texas. Adequate series from numerous localities in the regions of uncertainty, supplemented by breeding experiments if possible, should solve these problems entirely or in large part.

PARACYRTOPHYLLUS Caudell

Based in 1906 on the single species *robustus* Caudell, a second species is here included. Both of these show very striking specific differentiation, though plainly belonging to the same phylum.

The limb spination can not be given the generic importance which Caudell supposed that it had, as it is now known to be individually highly variable in the genotype and of no value in separating the other species from *Pterophylla*.

Though sharing with *Lea* Beutenmüller a similar general type of male cercal development, other characters prove these genera to be members of widely distinct phyla.

The genus, is as yet known only from central Texas and a very restricted zone in the mountains of the southwestern part of that state, though it probably occurs in similar environment in adjacent northeastern Mexico.

Three recently discovered (two as yet undescribed) Mexican species, however, all belong to a very different phylum or phyla, although two of them are from a not very distant locality in Nuevo Leon.

Paracyrtophyllus robustus Caudell (Pl. XIX, figs. 1 and 2.)

1906. *Paracyrtophyllus robustus* Caudell, Jour. N. Y. Ent. Soc.; xiv, p. 36, pl. I, figs. 1 to 6. [♂, ♀; Texas (type selected by Caudell and Hebard, 1912), ♀ Tiger Mills, Texas.]

Material from "Texas" recorded as *Cyrtophyllus concavus* (a synonym of *Pterophylla camellifolia*) by Scudder in 1862 is referable to the present species.

Specimens Examined: 28; 27 males and 1 female.

TEXAS: Romney, VI, 30, 1936, (Beamer, Jackson, Lindsay and Field), 14♂, [U. of Kans. and Hebard Cln.]. Leakey, VII, 8, 1936, (Beamer, Jackson and Field), 4♂, [U. of Kans. and Hebard Cln.]. Brownwood, VII, 28, 1931 (R. H. Painter), 1♂. Blanco Co., VII, 1931, (J. K. G. Silvey) 1♀, [Univ. of Mich.]. Fredericksburg, VII, 6, 1923, (C. H. Gable; on Live Oak), 3♂. Helotes, VII, 1, 1917, 2♂. "Texas," 1♂, [A.N.S.P.]. Luling, VIII, 15, 1935, (T. H. and G. G. Hubbell; two only heard and taken from tops of Post Oaks in open grove of three species of oaks), 2♂, [Univ. of Mich.].

This is the only species of the present group in which the dorsal margins of the cephalic tibiae are ever armed with spines. The present series, however, shows that great individual variation exists in this feature, as in three specimens these margins are unarmed and in five others the external alone bears a single spine. The range of these spines in the present series is from nothing to six for the external margin and the internal margin is normally unarmed, only six specimens showing there from one to three spines.

The variability in this feature (which Caudell had considered of major generic importance), combined with the fact that *excelsus* (Rehn and Hebard) is definitely more closely related to the present insect than to those we here assign to *Pterophylla* indicates that *Paracyrtophyllus* is by no means a strongly defined genus.

Like others of this group, the present species shows considerable variation in size and also in tegminal width. The largest individuals before me, which also have both pronotum and tegmina broadest, are from Brownwood, Blanco County and Luling, while the smallest males are from Helotes. None in the large series from Romney, though variable, approaches these extremes closely.

This handsome species is confined to central Texas where it is known only from the localities given above. Its distribution is probably considerably greater from North (Romney) to South (Helotes) than from East to West. It is arboreal and prefers oaks which are scattered through the region and are often the only trees present.

At Romney, members of a University of Kansas expedition found the species relatively abundant in a brushy area, where a fine series was taken from the scattered scrub oaks. These trees, though representing the highest present, were low enough to make location and capture of individuals after dark easier than is usually the case with arboreal species.

Hubbell writes that, at Luling, the song was a fast rasping series of short notes, separated by intervals somewhat longer than the syllables.

Paracyrtophyllus excelsus (Rehn and Hebard) (Pl. XIX, fig. 3.)

1914. *Pterophylla excelsa* Rehn and Hebard, Ent. News, xxv, p. 293, figs. 1 to 3. [♂, ♀; Moss Well at foot of Pulliam Bluff in Chisos Mountains, Texas, at 4700 to 5000 feet.]

Additional Specimens Examined: 2; 1 male, 1 female.

TEXAS: Chisos Mountains, VII, 18, 1921, (C. D. Duncan), 1 ♂, [Cal. Acad. Sci.]; Big Bend Park, VII, 25, 1927, (R. H. Baker), 1 ♀.

The unarmed dorsal margins of the cephalic tibiae and average more elongate, less robust form led originally to the placing of this species in *Pterophylla.* The instability of the first of the above features and the evident closer affinity to *robustus* shown by several important characters convinces me of the necessity of the present generic reassignment, though *excelsus* plainly represents a development annectant between the genotypes of *Paracyrtophyllus* and *Pterophylla.*

Common in low scattered oaks, *Quercus emoryi,* at the type locality, twenty three males were easily taken there by the author. A pair was also recorded from the Chisos Mountains. The large series secured shows quite considerable size variation although there is little diversity in proportionate tegminal length.

The song is an incessant rasp; "quuck — quuck — quuck — quuck," repeated very deliberately for long periods of time. Individuals are rather sluggish and much more fearless than the usual decticid, so that only patience is required to secure a series once a colony has been located.

PTEROPHYLLA Kirby

Described in 1828[4] by the elder Kirby, the genotype *Locusta camellifolia* Fabricius was selected by Kirby the younger in 1906.[5]

Burmeister's *Cyrtophyllus,* described in 1838[6] was correctly synonymized by the younger Kirby in 1906.

Serville's monotypic genus *Thliboscelus* 1839, was correctly synonymized by Caudell in 1911.[7]

Two species are here recognized; one, divided into three, the other into two, geographic races.

Though including the most abundant and widespread species of the group, its races as well as those of the second species are yet known from very little material. Additional series are much needed to determine the degree of variation which occurs in each of the more western races, as well as more exact data on their probably much restricted limits of distribution.

The genus is found throughout the eastern United States except in the more tropical portions of southern peninsular Florida (De Leon Springs is a southeastern limit) and the Florida Keys and in the northern portions of this country, and it occurs also in extreme southern Ontario. It is known westward as far as eastern Iowa, the southern portion of extreme eastern Kansas, eastern Oklahoma and eastern Texas.

The three recently discovered (two as yet undescribed) Mexican species, represent a distinctive phylum or phyla characterized by higher specialization, obviously derived from the present stock.

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[4] Introd. Ent., (5), II, p. 218. The name was proposed first in 1825, but at that time no species were included. (Zool. Jour. London, I, p. 432.)

[5] Syn. Cat. Orth., II, p. 343.

[6] Burmeister described *Cyrtophyllus perspicillatus* from a male from South Carolina, this constituting the genotype in that case since, although he included another species, he noted that *perspicillatus* was the only one he had seen. That name is now known to be a synonym of *camellifolia.*

[7] Ent. News, XXII, p. 167.

Pterophylla camellifolia camellifolia (Fabricius)
(Pl. XIX, figs. 4 and 5; pl. XVIII, figs. 2 to 5.)

1775. *L*[*ocusta*] *camellifolia* Fabricius, Syst. Ent., p. 283. [♀, America.]

1775. *L*[*ocusta*] *perspicillata* Fabricius, Syst. Ent., p. 283. [♂, America.]

1831. *Platyphyllum concavum* Harris, Encycl. Amer., VIII, p. 42. [♂, ♀; Mass.]

1859. *Platyphyllus zimmermanni* Saussure, Rev. et Mag. de Zool., 1859, p. 206. [♀, S. Car.]

1906. *Cyrtophyllus elongatus* Caudell, Jour. N. Y. Ent. Soc., XIV, p. 40. [♂, ♀: Pa.; Plummers Island, Md.; Piney Branch, D. C.; Falls Church, Va.; Crawford and Fountain (type locality [8]) Counties, Ind.]

The above indicates the established synonymy for the present race. Prior Texan records of this species or one of its synonyms are discussed here as follows; Scudder's under *Paracyrtophyllus robustus,* Caudell's under *Pterophylla furcata laletica* and Hebard's under *Pterophylla camellifolia intermedia.*

Limital records for *camellifolia camellifolia* are southeast to De Leon Springs, Florida. North to Wellesley, Massachusetts; London, Ontario; Ann Arbor, Michigan; and Winnetka and Putnam, Illinois. West to Delaware County and Ottumwa, Iowa; Lawrence, Kansas, and Tulsa and Ada, Oklahoma. Material is particularly needed from the Gulf Coast over probably a narrow southern margin in Alabama and Mississippi, but farther north in Louisiana and eastern Texas, before the exact southwestern limits of this race can be determined.

Although Blatchley believed that the insect prefers trees in the open rather than forests, I have found it much more numerous and generally distributed in extensive areas of deciduous forest, particularly where lofty oaks are numerous. Even though the oak scrub is not high in New Jersey, the extensive areas of such often afford excellent opportunity to secure specimens of this frequently inaccessible insect, while the heavily and extensively wooded slopes of the Appalachian Mountains in Pennsylvania and Virginia resound with their song on warm nights.

For Flag Rock Pass, Virginia, I made the following notes, " Many present. At night with hand flashlight individuals may often be located on branches, sometimes in foliage. They usually face toward one when the light shines in the tree, their faces then alone clearly visible, looking very pale among the leaves. Rarely do they show any alarm but often face the light and then, if not molested, climb slowly around to the other side of their perch. When touched with a long stick they usually tumble from their perch to the ground, occasionally giving a short preliminary spring. On the way down they partially spread their organs of flight, thereby using the principle of a parachute."

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[8] A male selected as type by Caudell and Hebard in 1912.

In the southeast I have often heard their loud chorus when passing through the lofty deciduous forests of the river swamps or " hammocks " of high oaks, but in those regions individuals were almost always highly inaccessible and difficult to secure. At De Leon Springs, Florida, this insect was heard to be abundantly present in the tops of the very high Water Oaks of a " hammock," where in the undergrowth at usually from fifteen to twenty feet from the ground, *Lea floridensis divergens* was also present but only in moderate numbers. The difference in character as well as quality of the song of these two species was very striking. A similar situation has been observed near Ormond, Florida, by Hubbell.

The song of this insect consists of two to five (usually three) exceedingly loud but pleasantly resonant notes, incessantly repeated, from which song the name " Katy-did " was undoubtedly derived. The sound has been described as " xr—, excessively rasping and grating " by Scudder, and it is surprising to find that both Morse and Blatchley also found it unpleasant. To me it is quite the reverse, exceptionally pleasing, as excellently and fully described by Caudell,[9] embodying a resonant fullness and enthusiasm which brings to mind leafy treetops on clear Summer nights.

Usually dwelling only in high deciduous treetops, individuals are often very difficult to secure. When, however, a colony can be located in either scrub or second growth forest areas where only low trees grow, series of males can at night be easily taken with the aid of a flashlight and a long pole. In the beam of the light their faces or undersides show up conspicuously whitish in the green foliage and when touched with the tip of the pole they leap clumsily and parachute down. On the ground they are both awkward and slow. Since females cannot sing, individuals of that sex are rarely located and collected by the above method.

During the first severe frosts or sudden cold storms in late Autumn, these insects often fall to the ground and when warmed the next day feebly attempt to climb back into the trees. At such a time it is probably easiest to secure females by examining the trunks of trees where a colony had been located earlier in the season, that sex also being predominant in late Autumn. Females have also been found ovipositing low on the trunks of trees.

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[9] Jour. N. Y. Ent. Soc., xiv, p. 32 and 40, (1906).

Specimens Examined: 167; 84 males, 66 females and 17 immature individuals.

CONNECTICUT: Lyme, VIII, 27, 1910, (B. H. Walden), 1 ♂, 1 ♀. New Canaan, IX, 19, 1907, (B. H. Walden), 1 ♂. (Other records by Walden, 1911.)

NEW YORK: Vicinity of New York City, 1 ♂. (Numerous other records by Davis 1926.)

NEW JERSEY: Delaware Water Gap, IX, 1 and 2, 1923, (H. Fox), 1 ♂. Lakehurst, VII, 28, 1922 to IX, 17, (majority by H. B. Weiss) 4 ♂, 7 ♀, [A. N. S. P. and Hebard Cln.]; IX, 17, and X, 1, 1939, (J. W. Cadbury; one attracted to molasses bait, others in low oaks in pine barrens), 5 ♂, 1 ♀, [A. N. S. P.]. Chatsworth, VIII, 20, 1912, (W. T. Davis), 1 ♂. Medford, IX, 27, 1914, (W. Stone), 1 ♀, [A. N. S. P.]. Spray Beach, Long Beach Island, IX, 16, 1915, (B. Long), 1 ♂, [A. N. S. P.]. Staffords Forge, VIII, 26, 1927, (J. A. G. Rehn), 1 ♀, [A. N. S. P.]. Malaga, VIII, 13, 1913, (H. A. Wenzel), 1 ♀, [A. N. S. P.]. Manumuskin, X, 20, 1902, (E. Daecke), 1 ♀. Ocean View, VIII, 11, 1936, (H. Fox), 1 ♂. (Other records by Fox, 1928.)

PENNSYLVANIA: Greentown, Pike Co., I, 23, 1927, (E. R. Tinkham; long dead on top of beech leaves in heavy woods), 1 ♀. Blue Mountains, Bucks Co., IX, 16, (S. F. Aaron; on summit, numerous, active and stridulating in daytime), 1 ♂, [A. N. S. P.]. Philadelphia, (J. Steiffer), 1 ♀, [A. N. S. P.]. Chestnut Hill, IX, 2, 1904, (M. Hebard; in small birch 30 feet above ground), 1 ♂. Elwyn, (C. S. Wells), 1 ♂, [A. N. S. P.]. Secane, (F. Aaron), 2 ♂, [A. N. S. P.]. Catawissa, IX, 4, 1 ♀, [A. N. S. P.]. Schuyler, IX, 19, 1 ♂, [A. N. S. P.]. Orrtanna, IX, 4, 3 ♀, [A. N. S. P. and Hebard Cln.]. Harrisburg, IX, 5, 1 ♀. Rockville, Dauphin Co., IX, 1, 1 ♀, [A. N. S. P.]. Camp Hill, Cumberland Co., VII, 16, 1 ♂, [A. N. S. P.]. Marysville, X, 7, 1 ♂. Duncannon, X, 2, 1 ♂. Waverly, IX, 20, 1928, 1 ♀. Millers Gap, Perry Co., IX, 23, 1914, (H. W. Fowler) 1 ♂, [A. N. S. P.]. Buffalo Gap, Union Co., 2600 ft., VII, 31, 1935, (Rehn and Rehn, "numerous on oak foliage in second growth deciduous forest not over 25 feet high; individuals rested with front legs and antennae forward, middle legs at right angles to body and hind legs at 45° to axis of body." Five pair raised to maturity August 5 to 11), 12 large juv. ♂, 10 large juv. ♀, [A. N. S. P.].

MARYLAND: Chestertown, VIII, 24, (E. G. Vanatta), 1 ♀, [A. N. S. P.]. Plummers Island, X, 28, 1918, (Rehn and Hebard), 1 ♀; XI, 11, 1915, (Hebard; found dead in deciduous woods), 2 ♀. Mount Quirauk to High Rock, Blue Ridge Mountains, IX, 11, 1937 (H. R. Roberts) 1 ♂, 1 ♀.

VIRGINIA: Flag Rock Pass, Warm Springs Mountain, 3000 to 3100 ft., VIII, 2, 1916, (M. Hebard; 1 immature bred adult VIII, 20), 2♀; VIII, 23, 1916, (M. Hebard; "in area of low oaks and some chestnut, singing vigorously at night; generally numerous in forest but obtained easily only in areas of low trees, for individuals are almost invariably in the tops of the tallest trees present"), 8♂. Hot Springs, 2400 ft., VIII, 23, 1916, (M. Hebard; on trellis under oaks) 1♀.

NORTH CAROLINA: Blowing Rock, 1902, (J. Willcox), 1♀, [A. N. S. P.]. (Other records by Rehn and Hebard, 1916, and Brimley, 1938.)

SOUTH CAROLINA: Myrtle Beach, Horry Co., VII, 22, 1940, (J. W. Cadbury; attracted to molasses bait on trunk of low oak in sandy pine woods near beach), 1♂, [A. N. S. P.]. Bateburg, VIII, 29, 1930, (R. H. Beamer), 1♀, [Univ. of Kans.]. No further data, (from Saussure Cln.), 1♀.

GEORGIA: Mountain City, VIII, 19, 1913, (J. C. Bradley), 1♂. Dillard, 2200 ft., IX, 3, 1917, (Rehn and Hebard: numerous in oak forest), 1♂. No further data, (from Saussure Cln.), 1♀.

FLORIDA: Gainesville, VI, 26 and 27, 1924, 1 large juv. ♂, 1 large juv. ♀; VI, 25 to VII, 16, 1924, 13♂, 8♀, (all F. W. Walker). (Heard but not taken at De Leon Springs by Hebard, IX, 8, 1917.) Wakulla Springs, VII, 14, 1934, (P. A. McKinstry), 2♂, [Univ. of Kans. and Hebard Clns.]. Township 2 N R 7 W, Liberty Co., VII, 24 to 30, 1925 (T. H. Hubbell), 8♂, 3♀, 2 juv. ♂, 1 juv. ♀, [Univ. of Mich. and Hebard Clns.]. De Funiak Springs, VII, 2, 1925, (T. H. Hubbell), 1♂, [Univ. of Mich.].

ONTARIO: (Reported from Niagara, London and Morpeth by E. M. Walker, 1904.)

OHIO: (Recorded as *C. concavus* by Meade, 1904.)

WEST VIRGINIA: North Fork Mountain Pass, Pendleton Co., 3600 ft., IX, 4, 1938, (J. W. H. Rehn), 1♂, [A. N. S. P.].

KENTUCKY: (Reported as moderately common locally by Garman, 1894.)

ALABAMA: Evergreen, VIII, 4, 1915, (M. Hebard; at night, parachuted out of Water Oak, falling with a thud; one male heard singing in a Water Oak the previous night), 1♀.

INDIANA: Muncy, Fall of 1907, 2♀. (Fully discussed and other localities given by Blatchley, 1920.)

MICHIGAN: (Recorded as *C. concavus* by Pettit and McDaniel, 1918.) (A northern limit is Ann Arbor, [Univ. of Mich.].)

ILLINOIS: Evanston, VIII, 15, 1899, 1♀. Lake Senachwine, Putnam Co., VII, 13 to 15, 1933, (Mohr), 1♂. Urbana, IX, 14, 1892, (Snow), 1♂. Charlestown, VIII, 23, 1910, (in woods), 1♂. (Other records by Hebard, 1934).

IOWA: Delaware Co., VIII, 5, 1932, 1♀. Louisa Co., VIII, 5, 1935, (G. Warren), 1♀. Ottumwa, IX, 8, 1937, (H. Knutson; on highway), 1♀.

MISSOURI: St. Louis, X, 9, 1904, 1♂. Mountain Grove, VII, 31, and VIII, 2, 1903, 1♂, 1♀. Willard, VIII, 17, 1919, (A. E. Brower) 1♂, 1♀.

ARKANSAS: Mountain View, Stone Co., 1100 ft., VIII, 11, 1939, (Rehn and Rehn; beaten from very low surface cover in scrubby deciduous and Red Cedar woods), 1♀, [A. N. S. P.]. Benton, VI, 29, 1938, (H. R.

Roberts; high in deciduous trees in pine woods), 3 ♂. Magazine Mountains, summit at 28 ft., VIII, 12, 1939, (Rehn and Rehn; numerous in oak and hickory forest about 30 ft. high), 1 ♂, 2 ♀, [A. N. S. P.].

NEBRASKA: Though recorded as "not rare in the wooded or eastern part of the state" as *Platyphyllum concavum* by Bruner in 1893, no specimen from there exists in any collection and the statement is in part if not wholly incorrect. It is possible that a northwestern limital point for the species will be found in the wooded bottomlands of extreme southeastern Nebraska, but its present known and authentic limital localities lie some distance to the southeast and south.

KANSAS: Lawrence, VIII, (E. S. Tucker) 1 ♂, [Univ. of Kans.]; IX, 1910, 1 ♂, (discussed by Hebard, in 1931, who also gave Independence as a western limit in 1934). Douglas Co., VII, 29, 1919, (W. E. Hoffman), 1 ♀, [Univ. of Kans.]. Coffeyville, VII, 11, 1933, (L. W. Hepnet), 1 ♂, [Univ. of Kans.].

OKLAHOMA: Adair, VII, 15, 1931, 1 ♀. Fort Gibson, VII, 20, 1937, (Standish and Kaiser), 1 ♂, 1 ♀. Tulsa, VII, 22, 1937, (Standish and Kaiser), 1 ♂, 1 ♀. Gore, VII, 20, 1937, (Standish and Kaiser), 1 ♂.

In the above material decided variation in size and shape of organs of flight, length of limbs and size of ovipositor, general contour and curvature of the arms of the male cercus and length and contour of the male subgenital plate is shown.

Considerable variation in size occurs, the minimum average being found in the northern portions of the insect's distribution and in the higher and more boreal portions of the Appalachian Mountains. In such material the male subgenital plate also shows conspicuously a maximum general reduction. A large series from Gainesville, Florida, includes much the largest specimens I have seen, but even in this series the size variation is considerable. Westward as far as eastern Iowa and eastern Missouri, the size average remains small, the male subgenital plate, however, showing frequently a slightly greater meso-distal expansion. The material from southwestern Missouri, Arkansas and northeastern Oklahoma averages larger with male subgenital plate averaging more elongate than elsewhere, the meso-distal expansion of that plate averaging greatest in the Oklahoma specimens. A male before me from South Carolina has the subgenital plate of intermediate length for the species but its meso-distal expansion very decided. In another from Myrtle Beach in that State, however, this plate is much as in the Florida series, it being elongate and only moderately expanded meso-distad.

Individual extremes in the development of the male subgenital plate appear very distinct, but intergradation to different degrees in different series is much too general, in my opinion, to warrant the use of this feature toward recognition of any geographic race.

The ventral arm of the male cercus frequently shows some convexity just after it begins to curve inward toward the apical tooth in much of my southeastern material. The fact that this feature varies individually in degree of development in all southeastern series and on the other hand is prominent in a few specimens from Pennsylvania, again precludes its being given racial significance. (See pl. XVIII, figs. 2 to 5.)

The length and width of the tegmina is much more apt to vary individually with little or no geographic significance. I believe that, as in *Paracyrtophyllus robustus,* this feature will prove to be merely adaptation to the character of the foliage constituting an individual's immediate environment during its period of growth. Individuals of this species, as a rule, move only comparatively very short distances during their entire life cycle.

Pterophylla camellifolia intermedia (Caudell) (Pl. XVIII, fig. 1.)

1906. *Cyrtophyllus intermedius* Caudell, Jour. N. Y. Ent. Soc., XIV, p. 41, pl. I, figs. 2 and 8. [♂; Biloxi, Miss.[10] (selected as type by Caudell and Hebard, 1912).]

Through the kindness of A. B. Gurney of the U. S. N. M. I have been able to study the type of this insect and am compelled to reverse my decision of 1931, which placed *intermedia* as a synonym of *camellifolia.* This type is in an excellent state of preservation and agrees fully with *camellifolia camellifolia* except that the rounded median lobe of the cercus is much more produced, being nearly as high as its proximal width and in direct vertical aspect projects slightly more than the inbent ventral arm. The arms are also heavier and shorter than is usual in the nominate race. Thus quite as definite divergence from *camellifolia camellifolia* is present as is found in a different part of the male cercus in the case of *camellifolia dentifera* here described.

I now know that the present race occurs little east of Biloxi, Miss., contrary to Rehn and Hebard's belief in 1914 when they first placed it as a race of *camellifolia,* since typical *camellifolia* has been taken as far west as De Funiac Springs in western Florida.

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[10] The originally described female from Wellborn (not Wellsboro), Texas, is referable to *camellifolia laletica* here described.

The male here recorded from Jefferson, in the northern portion of the very narrow humid strip along the eastern boundary of Texas, indicates that *camellifolia intermedia* probably occurs on the Gulf Coast from Mississippi to extreme southeastern Texas and for some distance inland, at least in the western portions of that region. The females from west of Biloxi recorded below, are tentatively assigned to the present race, males from the region being necessary to solve the problem.

The Jefferson, Texas male shows definite divergence toward *camellifolia camellifolia* in having the cercus with lobe lower, though high, well over half as high as broad and projecting almost as far as the lower arm.

My record of *camellifolia* from Rosenberg, Texas in 1931 is erroneous; at that time the specimen recorded below from Doucette was so labelled accidentally and the mistake remained unnoticed until recently.

Specimens Examined: 4; 1 male, 2 females, and 1 immature individual.

MISSISSIPPI: Orange Grove, VII, 10, 1934, (R. H. Beamer), 1 ♀, [Univ. of Kans.]. Lucedale, VI, 17, 1931, (H. Dietrich), 1 ♀.

TEXAS: Jefferson, VI, 21, 1938, (R. L. Sailer), 1 ♂, atypic, divergent towards *camellifolia camellifolia*. Doucette, VI, 21, 1912, (M. Hebard; only individual seen, on small bush near the bare ground in lofty deciduous forest), 1 large juv. ♀.

Pterophylla camellifolia dentifera new subspecies (Pl. XVIII, fig. 6.)

A single male before me, from a locality between the known southwestern limit of *c. camellifolia* (Benton, Arkansas) and the known southeastern limit of *f. furcata* (Broken Bow, Oklahoma) shows a definite step from the simple cercus of the other races of the former species toward the furcate cercus characteristic of the races of the latter. The species involved are so similar except in male cercal features that racial assignment of the present insect is difficult. From the evidence at hand, however, I believe that the present condition should be associated with *camellifolia,* though it is evident that the races here recognized of *furcata* represent decidedly higher specialization of a similar general type of male cercus. I have here considered *furcata* a distinct species, due to its much higher cercal specialization coupled with definite differences in habitat and song. Additional material, particularly from extreme southwestern Arkansas, extreme northwestern Louisiana and extreme northeastern Texas, must be secured to establish finally the exact degree of relationships here extant.

At the present type locality even the regional conditions are probably intermediate between the comparatively humid eastern forests which are the habitat of *camellifolia* and the drier and lower deciduous (largely oak) forests to the west and southwest in which *furcata* is found.

Type.—♂; Fulton, Hempstead County, Arkansas. July 3, 1937. (H. R. Roberts.) [Hebard Cln. Type No. 1332.]

Generally similar to the nominate race. Cercus with ventral arm short and stout, bent inward distad at a right angle, at which point projects caudad a small straight sharp tooth approximately as long as its proximal width. Otherwise probably indistinguishable from *c. camellifolia,* but showing in this specimen the following features. Size medium. Tegmen very broad, short and very broadly rounded distad. Male subgenital plate strongly produced with meso-distal expansion prominent; not as strongly produced as the average in our Arkansas series of typical *camellifolia* but much as the average in those of that race from northeast Oklahoma. Limbs short. Ventro-cephalic margins of cephalic femur with two and two, of median femur with three and five, very small teeth, ventro-caudal of all femora unarmed; ventro-external margins of caudal femur with three and six slightly larger teeth.

General coloration light green, with stridulating area light brown. Antenna not pinkish proximad.

Length of body (not including subgenital plate) 27.5, length of pronotum 5.1, greatest (caudal) width of pronotal disk 5.9, length of tegmen 33.8, greatest width of tegmen 17.8, length of caudal femur 18.9, greatest width of caudal femur 3 mm

This insect was abundant in the mixed forest, where the present specimen was taken from a deciduous tree about twenty feet high.

Pterophylla furcata laletica new subspecies (Pl. XVIII, figs. 7 and 9.)

This southern race is separated from typical *furcata* only by the less decided, though very prominent, furcation of the ventral arm of the male cercus, the production distad (outer branch) being considerably shorter and less robust than the inbent distal portion (inner branch). This is obviously one step in the cercal development from that of *furcata furcata* toward that which distinguishes *camellifolia dentifera* less strongly from *camellifolia camellifolia.*

Females of these races are apparently indistinguishable. Referable here, from distributional evidence, is the female from Wellborn (not Wellsboro), Texas, described as this sex of *Cyrtophyllus intermedius* by Caudell in 1906 (which I have recently examined).

The race occupies most of the extensive more arid western portion of eastern Texas. In the narrow humid eastern margin of Texas, it is supplanted by *camellifolia camellifolia* or *camellifolia intermedia* in the south and probably by the former race or *camellifolia dentifera* in the extreme north. It is supplanted by *furcata furcata* in southeastern Oklahoma. Sufficient material is not yet available to determine the exact limits of distribution and amount of intergradation existing between these races.

Type.—♂; Palestine, Texas. August 16, 1915. (M. Hebard). [Hebard Cln. Type No. 1333.]

Cercus with ventral arm short and stout, bent inward distad at a right angle, at which point projects caudad a large tooth, approximately twice as long as its proximal width, its bulk about one-half that of the distal inbent portion of the arm and approximately two-thirds as long as that section. Otherwise probably indistinguishable from *f. furcata,* but showing in the type and paratype the following features. Size large. Tegmen very broad as well as elongate, distal margins very broadly convex convergent to the relatively narrowly rounded apex, which lies nearest the sutural margin. Male subgenital plate strongly produced with meso-distal expansion prominent, though not as prominent as in the series of *f. furcata* before me. Limbs short. Ventro-cephalic margins of cephalic femur with four and four (five and five in paratype) of median femur with four and four (five and five in paratype), very small teeth, ventro-caudal of all femora unarmed (except that one such tooth is present distad on these margins of the median femora in paratype); ventro-external margins of caudal femur with five and seven (five and six in paratype) slightly larger teeth.

General coloration light green with stridulating area light brown. Antenna not pinkish proximad.

The measurements of the type are followed by those of the paratype. Length of body (not including subgenital plate) 31 and 27, length of pronotum 5.8 and 5.6, caudal width of pronotal disk 6.8 and 6.7, length of tegmen 36.8 and 34.7, greatest width of tegmen 17.9 and 16.8, length of caudal femur 20.9 and 20.2, greatest width of caudal femur 3.7 and 3.6 mm.

Specimens Examined: 13; 12 males and 1 female.

TEXAS: Palestine, VIII, 16, 1915, (M. Hebard), 2♂, *type* and *paratype*. Waxahatchie, VI, 30, 1938, (H. R. Roberts; in fairly tall oaks in park), 1♂. College Station, VII, 23, 1938, (Sailer and Craik), 9♂, 1♀, [Univ. of Kans. and Hebard Clns.].

The series from College Station shows the following variation. Antennae with joint intersections beyond bases darkened, this very weak in one and obsolete in three, the female among the latter having these organs dull pink beyond their bases. Occiput dark with dark suffusions continued along lateral margins of pronotum in one, but these markings lighter and more suffused in four others, the same but very weak in two, occiput alone dark in one and head and pronotum immaculate in one pair. Male cercus with distal (outer) fork of ventral arm from slightly under two-thirds to slightly over three-fourths length of inner arm.

In covering about three miles in a Post Oak area near Palestine at night I heard five males at one place, one at another. The two specimens taken were in Post Oaks about twelve feet from the ground. Their song was very loud and harsh—"Grruck —— grruck —— gruuck —— grruck," often continued for a considerable period of time. A series could probably have been secured if more time had been available.

Pterophylla furcata furcata (Caudell) (Pl. XVIII, fig. 8.)

1906. *Cyrtophyllus furcatus* Caudell, Jour. N. Y. Ent. Soc., xiv, p. 41, pl. I, fig. 9. [♂, origin doubtful.]

1926. *Pterophylla furcata* Hubbell, Proc. Okla. Acad. Sci., vi, p. 177. [♂; Broken Bow, Oklahoma.]

I have examined the type in the National Museum which, though discolored, shows the same cercal structure as the males discussed below. This specimen came from the oldest portion of the Bruner Collection and, I believe, was incorrectly labelled "West Point, Nebraska." It appears highly probably that *furcata furcata* enjoys only a very limited distribution, possibly confined to southeastern Oklahoma and southward limited by *furcata laletica,* while northward it is supplanted in northeastern Oklahoma by *camellifolia camellifolia.* Furthermore the valid known northwestern limits for *camellifolia camellifolia* extend only to central eastern Kansas, eastern Iowa and northern Illinois, so that the present species should no longer be included in either Nebraska or Kansas lists.

Specimens Examined: 13; 8 males and 5 females.

OKLAHOMA: Page, IX, 14 and 15, 1935, (T. H. and G. G. Hubbell; abundant in oaks from eight to twenty feet above ground in scrubby Post Oak, Black Jack and pine forest on dry hillsides), 7♂, 5♀, [Univ. of Mich. and Hebard Clns.]. Broken Bow, VII, 8, 1925, (A. S. Ortenberger), 1♂, [Univ. of Mich.].

The known series shows that only in the character of the male cercus can this insect be separated from *camellifolia.* Though this difference appears very great, it must be noted that two stages between it and typical *camellifolia* are here described as geographic races of these two species.

In the males the ventral arm of the cercus is short and stout, bent inward distad at a right angle, at which point projects caudad a large horn-like process as thick or thicker at its base than the distal inbent portion of the arm and slightly to fully one-third longer than that section, tapering and slightly curved to its sharp apex. Male subgenital plate strongly produced with meso-distal expansion very prominent, this expansion averaging slightly greater than in the males of *furcata laletica* and the plate even longer and more expanded than in the maximum condition developed by *camellifolia camellifolia* (in Kansas, Arkansas and northeastern Oklahoma).

Hubbell writes that at Poteau, Oklahoma, on June 18, 1938, W. F. Blair secured a large series, where the species was abundant in hickories and Post Oaks from three to ten feet above the ground.

LEA Caudell

This genus was described in 1906 to include a single species, *Cyrtophyllus floridensis* Beutenmüller. This species was divided into a northern and southern geographic race by Hebard in 1939. It is locally distributed throughout eastern peninsular Florida but has yet been reported only from Fort Myers in the western portion and is probably absent from the Keys.

It much prefers Cabbage and Saw Palmettos, but is also found in scrub oaks, vine tangles and the thick bushes and tall weeds of sandy coastal areas or those bordering areas of heavy tropical vegetation and rarely in such areas in the south. Rarely has it been heard high in oaks and at De Leon Springs, in a " hammock " of tall oaks it was present in moderate numbers in the undergrowth, where *Pterophylla camellifolia camellifolia* could be heard but not taken, though in large numbers, in the lofty treetops. In fact, its preferred habitat is palmettos and bushes instead of the top's of the highest trees, though the latter is the favorite environment of the members of *Pterophylla.*

Lea floridensis divergens Hebard (Pl. XIX, fig. 6.)

1939. *Lea floridensis divergens* Hebard, Trans. Amer. Ent. Soc., LXV, p. 166, pl. X, fig. 29. [♂, ♀; Pablo Beach, St. Augustine, Pomona, Ocala, De Leon Springs, La Grange, and Orlando, Florida.]

As may be noted from the characters given in the present key, this northern geographic race shows a less conspicuous divergence from the general type characteristic of *Pterophylla,* than does the southern race *floridensis floridensis.*

It is locally distributed in Cabbage Palmettos and bushes in pine flatwoods, in bushes near Cabbage Palmettos back of coastal sand dunes and also in the undergrowth of oak "hammocks." Once located at night by their song, males are usually found to be sluggish in their movements and easy to capture, as rarely is one located high in a tree.

The song is a peculiar wooden "grruck."[11] This single note is regularly repeated, usually about thirty eight per minute but I have heard the frequency raised to nearly sixty a minute when an individual became excited. At De Leon Springs we had the opportunity to compare it with that of *Pterophylla camellifolia camellifolia* and noticed that it is decidedly weaker and of lower pitch.

I have seen only two males, listed below, additional to the nineteen males and two females originally described, but the two males which, I find from my field notes I heard at Kissimmee, high up in Water Oaks in a dry "hammock" on September 9, 1917, were probably representative of the present race.

FLORIDA: Benson Junction, Volusia Co., VIII, 30, 1938, (Hubbell and Friauf), 1 ♂, [Univ. of Mich.]. Eau Gallie, VIII, 7 and 8, 1938, (Hubbell and Friauf), 1 ♂, somewhat divergent toward *floridensis floridensis,* [Univ. of Mich.].

From notes very kindly furnished by Hubbell I find that he has also taken twenty-four males and six females of this race, among which three males and two females are of a light pinkish brown color phase. The series was secured at Satsuma, Juniper Springs, Doe Pond, Niggertown Lake, (the last three localities in the Ocala National Forest), Glenwood and Leesburg; the adults from July 24 to September 6, but large immatures as early as June 8. It was found common once in pine and oak scrub, the majority in oaks ten to thirty feet above the ground; once in oaks, Cabbage Palmettos and vine tangles. Three females were found ovipositing near the ends of dry broken stalks of Cabbage Palmetto fronds still attached to the trunks. A slit is cut on the lower face of the stalk, entering slightly obliquely and along the grain.

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[11] Described by Davis as, "chluck."

This insect has twice been found in small numbers in the undergrowth of a "hammock" where in the tops of the lofty oaks *Pterophylla camellifolia camellifolia* was abundantly present; near Ormond by Hubbell, and at De Leon Springs by Rehn and Hebard.

Lea floridensis floridensis (Beutenmüller) (Pl. XIX, figs. 7 and 8.)

1903. *Cyrtophyllus floridensis* Beutenmüller, Bull. Amer. Mus. Nat. Hist., XIX, p. 637, 2 text figs. [♂; Indian River opposite Grant, Florida.]

1939. *Lea floridensis floridensis* Hebard, Trans. Amer. Ent. Soc., LXV, p. 168. [♂, ♀; near Grant (slightly atypical), St. Lucie, Juno, Miami, Coral Gables and Homestead.]

This southern geographic race may be distinguished by the features noted in the present key. Its definitely optimum development gives it a distinctive appearance. It is known only from the southern portion of peninsular Florida, where, on the East Coast it has been found from Homestead and Paradise Key (in the Everglades) north to near Grant on the Indian River, at which latter locality intergradation with the northern race is shown.

The race is very locally distributed. Colonies, sometimes of moderate size but often widely separated, are known to prefer a Cabbage or Saw Palmetto habitat in sand dune coastal scrub, among second growth pines and on the borders of or in "hammocks."

I have seen only six pairs. Hubbell writes that at Paradise Key, from August 30 to October 21, he secured ten males and one female in shrubbery and vines usually at five to fifteen feet from the ground, where it was present in small numbers and even scarcer in the tall trees of the dense tropical "hammock." A small tree having aromatic leaves seemed to be a favorite habitat; several specimens were taken from it and one had been eating the leaves, this easily recognized by the pleasant spicy odor of the crop contents.

During extensive field work in the Florida Keys, I have never heard or seen it. It is probably this race which H. F. Strohecker writes me that he heard at Fort Lauderdale and Fort Myers, the latter constituting the only known record for the genus in southwestern Florida.

Among the thirty-six specimens from Coral Gables, which Strohecker recorded in 1939, one male and five females are light pinkish brown, all of these having been taken from dead brown fans of the Cabbage Palmetto.

That author states that the insect was first heard on June 1, adult seasonal abundance being greatest about the middle of July and that by August 25 only occasional individuals were heard. Specimens were found hiding in the folds of palmetto fans during the day, but more locally than is the case with many of the species of *Belocephalus*. Males, when located at night by their song, can be easily captured with a light as they are then moving about very deliberately and are not at all alert.

Explanation of Figures

PLATE XIX

(Figures natural size)

Fig. 1.—*Paracyrtophyllus robustus* Caudell. Dorsal view of male. "Texas." (Pronotum appears to have caudal margin extremely truncate, this partly due to the caudal portion being more reflexed than is usual.)

Fig. 2.—*Paracyrtophyllus robustus* Caudell. Dorsal view of male. Romney, Texas.

Fig. 3.—*Paracyrtophyllus excelsus* (Rehn and Hebard). Lateral view of female. Big Bend Park, Chisos Mountains, Texas.

Fig. 4.—*Pterophylla camellifolia camellifolia* (Fabricius). Lateral view of male. Mountain Grove, Missouri. (Showing very considerable production of subgenital plate, particularly striking in series from the southwestern portions of the distribution of this race.)

Fig. 5.—*Pterophylla camellifolia camellifolia* (Fabricius). Dorsal view of female. Gainesville, Florida.

Fig. 6.—*Lea floridensis divergens* Hebard. Dorsal view of male. *Type.* Pablo Beach, Florida.

Fig. 7.—*Lea floridensis floridensis* (Beutenmüller). Dorsal view of male. Coral Gables, Florida.

Fig. 8.—*Lea floridensis floridensis* (Beutenmüller). Lateral view of female. Coral Gables, Florida.

PLATE XVIII

(Figs. 1, 7, and 8, dorsal view of male cercus, much enlarged. Figs. 2, 3, 4, 5, 6, and 9, dorsal view of ventral arm of male cercus, very much enlarged.

Fig. 1.—*Pterophylla camellifolia intermedia* (Caudell). *Type.* Biloxi, Mississippi. (Drawing made through the kind cooperation of I. J. Cantrall.)

Fig. 2.—*Pterophylla camellifolia camellifolia* (Fabricius). Chestnut Hill, Pennsylvania.

Fig. 3.—*Pterophylla camellifolia camellifolia* (Fabricius). Tulsa, Oklahoma.

Fig. 4.—*Pterophylla camellifolia camellifolia* (Fabricius). Gainesville, Florida.

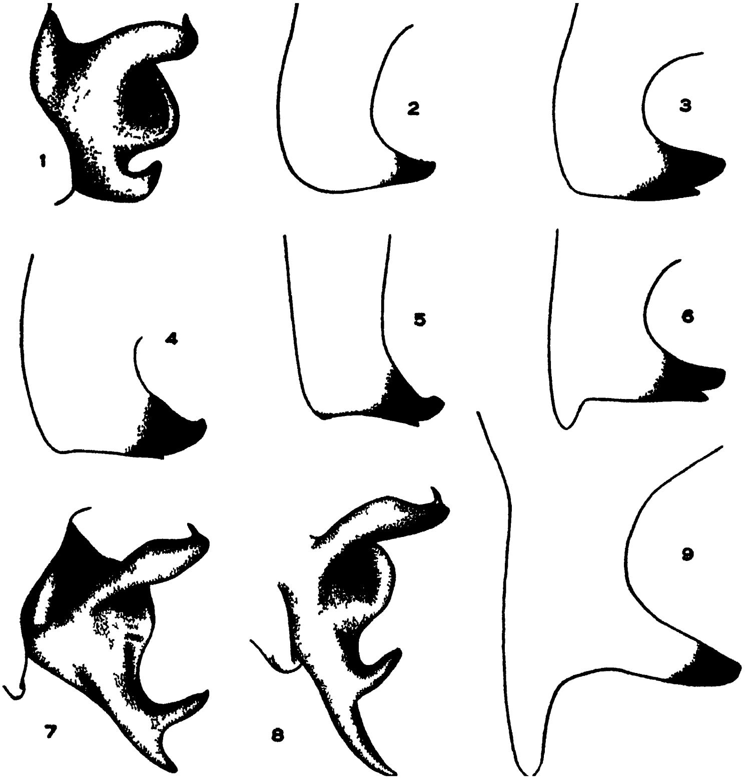
Fig. 5.—*Pterophylla camellifolia camellifolia* (Fabricius). Orrtanna, Pennsylvania.

Fig. 6.—*Pterophylla camellifolia dentifera* new subspecies. *Type.* Fulton, Arkansas.

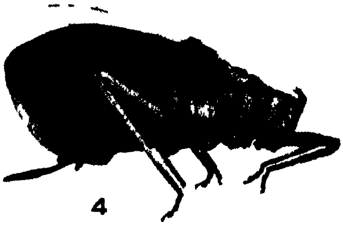
Fig. 7.—*Pterophylla furcata laletica* new subspecies. *Type.* Palestine, Texas.

Fig. 8.—*Pterophylla furcata furcata* (Caudell). Page, Oklahoma.

Fig. 9.—*Pterophylla furcata laletica* new subspecies. *Type.* Palestine, Texas.



HEBARD—AMERICAN PTEROPHILAE



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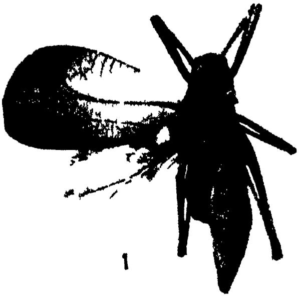

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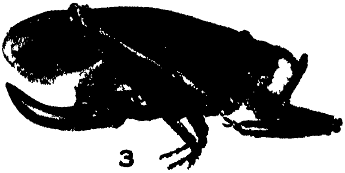

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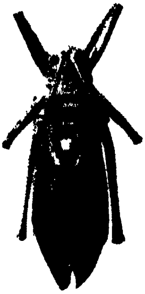

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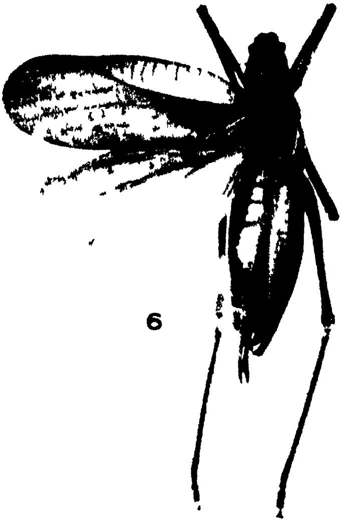

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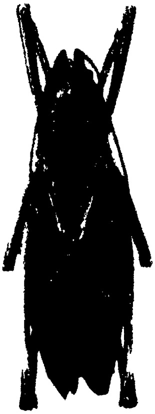

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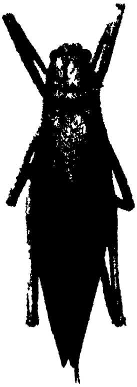

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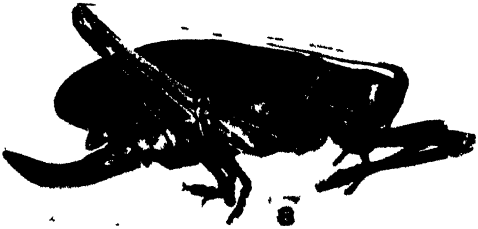

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HEBARD—AMERICAN PTEROPHILAE

LIFE HISTORY STUDIES ON PROGOMPHUS AND ITS NEAREST ALLIES

(ODONATA: AESCHNIDAE)

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(Plate XX and text figures)

The New World Genus *Progomphus* of de Selys is mainly neotropical in distribution, with only three species as yet known to occur within the limits of the United States. Our knowledge of immature stages in the group is limited to the nymphs of these three species, a very full account of which has recently (1939) been published by Dr. C. F. Byers. These three, *Progomphus obscurus* Rambur, *Progomphus borealis* Selys and *Progomphus alachuensis* Byers, are large, closely allied species whose nymphs represent one extreme of lotic specialization, adapting them to burrowing in submerged beds of loose sands. There have been hitherto no descriptions of any of the nymphs of the numerous and somewhat heterogeneous small Neotropical species. A few of these that have come into my hands seem to furnish additional data for the systematic arrangement of the group. In the following pages I want to present some of that data.

The new material has come from various sources. I have myself collected the nymphs of three West Indian species, and have reared two of them. I have also collected the nymphs of two additional species in Mexico. Dr. Philip P. Calvert has kindly turned over to me for study a number of nymphs of his own collecting and others sent to him by collectors in Mexico and in southern Brazil. Especially valuable is the specimen of *Progomphus longistigma* that he took in transformation in Costa Rica in 1909, and that he has allowed me to describe herewith.

Issued September 29, 1941

I have a number of nymphs of three additional species sent me by Dr. R. von Ihering from Ceara Brazil; a single nymph of unique form sent me by Eduardo Mondolfo from Venezuela; and a cast skin of another very distinct species from Guatemala sent me long ago by the late E. B. Williamson. Until there have been further rearings, making possible the positive determination of the species, it is hardly worth while to publish detailed descriptions of nymphs of unknown species; but their divergences in structure will be briefly indicated in a table to show something of the range of form to be found within the genus.

Other items hereinafter to be added are a description of the supposed nymph of the closely allied genus *Desmogomphus* of Williamson, and some indications of the unexpected convergence in form of the nymphs of the more primitive members of the genera *Progomphus* and *Erpetogomphus.*

I. WEST INDIAN SPECIES OF PROGOMPHUS

The three species that I collected in Santo Domingo in 1940 were all new records for that country. One of them *Progomphus serenus* Selys, I reared. *Progomphus integer* Selys I had previously reared in Cuba in 1937. The third was a new species, the nymph of which is here hereinafter described.

Progomphus integer Selys (Pl. XX, fig. 4.)

At the Atkins Institution of Harvard University, Soledad, Cuba, I had the good fortune to be a guest investigator in April 1937. While there I searched for Gomphines, first in the ponds and little streams of the Botanic Garden, where I found *Aphylla,* but no *Progomphus.* Then I asked where to find a larger stream with sand bars in it. Mr. Walsingham, Assistant Superintendent of the Garden, suggested the Arimao River, and then he took me to it. We went together on horseback some three miles eastward by a sinuous trail through pastures and forestry plantations. Arriving at the river, Mr. Walsingham left me and my horse to our own devices, and I had an hour of ideal *Progomphus* nymph collecting.

The river at low water was a beautiful clear-flowing stream perhaps a hundred feet wide, bordered on one side by dense thorny scrub and on the other by forest. The trail, cut through the scrub, approached it at a rapids where there was a ford near a place known as Batey Vequicita. I collected first among the stones in the rapids but found there no dragon nymphs at all. Instead there were plenty of orange colored bag-making caddisworms, and prawns and other small crustaceans. Some of the latter were disporting themselves by leaping several centimeters into the air. They fell back into the water roundabout like the silvery spray of a fountain. It was a delightful performance to watch; but that was not what I had come for: nor was the fine display of fresh-water sponge enveloping the submerged stones of the river bed. It formed a thick velvety layer of vivid green color on which the osteoles were grouped by twos and threes all over the smooth upper surface.

Below the riffle was the sand bar I sought. It was a long bar of rather coarse sand, most of it in water of wading depth. There I found the nymphs of *Progomphus integer* in great abundance. Their trails on the surface of the sand were visible through the clear water: little grooves, like miniature clam trails that are so often seen on mud bottoms of lakes, criss-crossing in every direction. The nymphs appeared to be most abundant in places where a little brownish sediment overlaid the surface of the sand. I could gather a dozen or more of them with each sweep of the little hand sampling-net that I carried.

Nymphs of all ages were present, with complete intergradation in size. Many were full grown and a few were quite ready for transformation. Indeed one died in my pail in transformation on the way back to the Garden, being unable to withstand the jostling of three miles on horseback. The others, when placed in clean sand and water on my table, at once burrowed out of sight. Three days later one of them transformed successfully, and that specimen is now in the Cornell University collection.

I examined the food remains in the alimentary canal of several of these nymphs and found it to consist mainly of small Chironomid larvae (easily recognizable as such by the head capsules and drag hooks present) with a mixture of Oligochete worms (recognizable by their bristles).

I saw no adult *Progomphus* at the river; perhaps the season was a bit too early. The only other dragonfly seen was a lone *Macrothemis celeno,* flying over the stream.

Returning to Cuba in March 1937 with Dr. J. C. Bradley, and taking his automobile to facilitate getting around, I was able to collect nymphs of *integer* in the following places:

1. Arroyo Navarro, in a small silt-laden mountain stream.
2. Arroyo Rancho Capitan, in Finca Mameya. I was kindly guided to these two places, and assisted in collecting in them, by Mr. David Sturrock, Superintendent of the Botanical Garden at Soledad; they are in the Trinidad Mountains.
3. Soledad in a little spring fed brook that flows out of the woods beside the cactus garden—a place not reached in my earlier visit.
4. Westward, at El Retiro in Pinar del Rio in the Rangel range of the Organos Mountains.
5. A brook where it flows out of the limestone cave locally known as the "Lost World" north of Vinales in the same mountains. I was kindly guided to these two last named places by Dr. S. C. Bruner.
6. San Diego de los Banos, half way back to Havana, near the eastern border of the province of Pinar del Rio; down stream from the baths below the first dirt-road crossing. On another trip Dr. J. C. Bradley collected a pair of adults at los Banos on July 6th, 1940.
7. Vento, near Havana, on April 20th.
8. A small creek north of the city of Camaguey, on the 18th of April.

From this collecting experience, and from adult specimens sent me by Brother Clement from various places in the province of Oriente, I conclude that this species is generally distributed in the streams of Cuba wherever suitable conditions are found.

After rearing *P. integer* and learning how to recognize its nymph, I went back to collections made during my first visit to the island in 1930[1] and found that I had then collected it in two other places. The nymph may be described as follows:

Nymph. Length 22 mm.; abdomen 15; hind femur 4; width of head 4; of abdomen 6.

It is almost without color pattern, save for the black eyes and some not very prominent dots upon the abdomen. The exposed margins on head and thorax are a little darker than the general surface, and there is a touch of brown at base and nodus of the wing pads. There is a pair of small submedian brownish dots on abdominal segments 3 to 9 with a larger irregular pair just behind the pair on 7. There is a pair of oblique brown dashes on a paler background on the under side of segment 10.

The antennae (Pl. XX, fig. 4) are depressed-cylindric on the long hairy third joint. The fourth joint is a little longer than the third is wide, and tapers slightly to a blunt point, and is strongly recurved to lie on the dorsum of the third.

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[1] On that airplane trip of 1930 I collected nymphs that appear to be the same species from a creek in the island of Trinidad a few miles from Port of Spain on the principal road eastward, guided by the late Mr. F. W. Urich.

The abdomen is slender with segment 9 a little longer than either 8 or 10, and the caudal appendages about a third longer than 9. There are long strong sharp spinelike dorsal hooks on 1 to 9; lateral spines on 5 to 9, small but distinct on 5, and slightly smaller again on 9, but all are sharply pointed.

Progomphus serenus Selys (Pl. XX, fig. 5; text-figs., 1–4.)

This species has been known from a single Haytian specimen in the Museum of Comparative Zoology at Cambridge, Massachusetts. In March 1940 I went to Santo Domingo to try to find it. I accompanied Dr. and Mrs. Julio Garcia Diaz, travelling in their automobile. We went all over the Republic, stopping wherever there was promise of good picking for dragonflies. We collected first in the streams of the southeastern coastal plain, a number of which are crossed by the highway from Hato Mayor to Higuey. There we found no Gomphines at all, although there were other Odonata in plenty. Then we crossed the central mountain range and the Vega Real, and drove on out through Santiago northwestward on the main highway to Monte Christi on the north coast. A little way beyond Santiago, where the country becomes dry, attaining semi-desert conditions, deciduous woods border the highway. The trees were then as bare as are Kentucky woods in winter; their branches, though lacking leaves were tufted with bromeliads and other gray and lifeless-looking epiphytes. The streams were all run dry—all save one—in a season of extreme drouth.

That little live stream—the only one we found on all the way to the coast at Monte Christi—was the Rio Jicomé. It was reduced to a mere rivulet of water meandering down a wide bed. It looked so unpromising that we were passing it by, when by good fortune Mrs. Garcia insisted that we go back and take a try at it. It proved to be one of our best collecting grounds in the whole Island. Among the many Odonata found there were two species of *Progomphus,* one of which later, on rearing, proved to be *serenus.*

These nymphs were found in the little sand bars formed here and there in the edges of the stream; bars so small that one of them might be swept almost out of existence by a single stroke of a sieve net. The nymphs were burrowing shallowly in the sand, always where there was no rooted vegetation, and generally where there was a thin top layer of silt. They were not common. On that first trip I got only five nymphs of *Progomphus* in several hours diligent collecting.[2] One of the five *Progomphus* nymphs collected at this time was *integer*. The others were obviously of a different species, and one was well grown. I had hope of rearing it, but it died before transformation.[3]

We returned to the search in June, the three of us, with car and collecting outfit. We went back to the little Rio Jicomé. I got many nymphs of *serenus* this time, but no more of *integer*. I put about a dozen grown specimens in a cage and took them up in the mountains to San Jose de las Matas, where I could keep them under natural conditions in a brook in a private estate, safely.

The brook was in the country place, "Los Algarobas," of Senor Manuel Tavares of Santiago. We stayed a week in this delightful place collecting round about by day, setting new cages every night, and taking care of our new rearings every morning. I succeeded in rearing many dragonflies there, including one specimen of *serenus*. That week was memorable for the great hospitality shown us, and for the intelligent aid generously given our scientific undertakings.

The country round about Las Matas is a beautiful region of pine woods at elevations around 2000 feet, there are many fine streams, some of which we visited. With the help of Sr. Raymondo Alvarez I collected additional nymphs of *serenus;* two in Arroyo Hondo in mixed sand and gravel in the bottom of a deep gorge; three in Rio Ámina, near its junction with Rio Inoa, in the quieter places of a rushing torrentuous stream; and several in Bajo Millo; but in all these places the specimens were few and far between.

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[2] The net used was too big, and gathered too much stuff for each sifting. I found on a later trip that a little one-hand sampling net, with which I could quickly skim the surface layers of the bar, was more efficient, yielding many more nymphs of *Progomphus* in much less time.

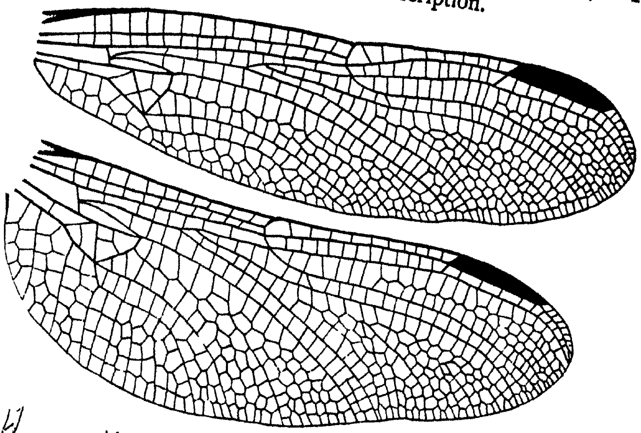
[3] Nymphs of *Macrothemis celeno* could be collected from the near-by trash in the edges of the stream at every stroke of the net, and nymphs of *Scapanea frontalis* were only a little less abundant. Climbing on the weed stems in the riffles there were many nymphs of *Enallagma coecum,* while those of *Orthemis ferruginea* and of *Dythemis rufinervis* were taken from the muddy places less frequently. There must have been some nymphs of *Aphylla caraiba* living somewhere round about, for we caught two adult specimens resting on the banks of the stream. Incidentally I may mention as a matter of record that I saw an adult of *Aphylla caraiba* in the entomological collection of the Agricultural Experiment Station at Jaina, believed to have been taken somewhere about the Station, which is in that western suburb of the Capitol city on the south side of the Island.

Bajo Millo was a place very difficult of access; but as it yielded nymphs of a third species of *Progomphus,* the adult of which is still unknown, I add this note concerning its location. It lies some five kilometers south of Las Matas in direct line, but very much farther by the rough, steep, and winding roads we had to follow to reach it. There was a sawmill at a fork in the main stream, engaged in cutting pine logs two and three feet in diameter into boards. A few adults were flushed from their resting places on the log piles at the fork in the stream, and three were captured. Another was taken in a narrow arroyo across from the mill, and a little way upstream.

Returning homeward across the central range on June we stopped at a place where the Jima River parallels the Duarte highway and there encountered *Progomphus serenus* again. Walking along the aggrading bank of the river where it was covered with water worn stones backed on higher ground by low bushes, we now and then discovered an adult as it was ending a short flight by settling upon the top of a stone. It was not difficult by careful approach to get within net-handle-reach of the insect, but it proved very difficult to get the insect into the net; for it could get away with a very low start. It was an artful dodger, and usually left an empty net sweeping the bare stones. Dr. Garcia first discovered that by walking at the water's edge, and so flushing the adults toward the land, they would generally settle at a higher level on the first available bush, where it was much easier to get a net around them. Thus we got several specimens. They spend most time sitting quietly in the sunshine, always perching low.

The single adult female that I reared at Las Matas is a very imperfect specimen, barely sufficient for specific determination. It transformed on a rainy night and fell or was washed into the water before it was well colored, and worse yet, its abdomen is entirely lacking; probably eaten off by some more active compatriot *Progomphus* nymph in the same cage. The wing venation was well developed however (as may be seen in the accompanying figure 1); and the stripings of the thorax show faintly, and agree with those of the other adults. We saw no adults on the Jicomé.

The only references that I can find in our literature to this species are the original description of the male by de Selys (1878, p. 69), an earlier mention of it without description by Uhler (1876, p. 295) and a listing of it by Byers (1939, pp. 26 and 30). The new material permits more complete description.



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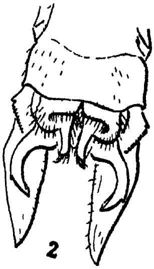

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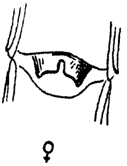

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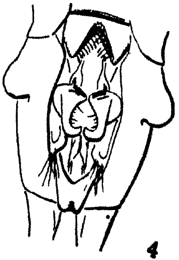

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Text-figures, *Progomphus serenus*. Fig. 1, Wings. Fig. 2, Anal appendages of male. Fig. 3, Vulvar lamina of female. Fig. 4, Genitalia of second abdominal segment of male.

Adult. Male. Length 42 mm.; abdomen 31; hind wing 24.

This is a slender blackish species, barred with grey on the face and striped with greenish yellow on the thorax. The blackish face is marked with grey in a wide border on the labrum, a large spot each side of the post clypeus, and all the prominence of the frons. The anteclypeus is whitish, and the sides of the mandibles are white. The black of the vertex broadly invades the grey on the upper side of the frons. A narrow ring of white surrounds the base of each antenna. The occiput is greyish-green, margined all around with black. The rear of the head is black with three spots each side next the border of the eye.

The front of the black synthorax bears two opposed 7-marks, narrowly separated from each other at junction of carina and collar. The antehumeral yellow stripe is sometimes interrupted, being broken into three spots; a roundish one above the front coxa, a streak above that one, and a broadly triangular spot high up underneath the outer end of the crest. The yellow mesepimeral stripe is entire and well isolated at both ends. The metepisternal stripe is broken into four spots: a crescentic one above the coxa, and another crescentic one above that one and touching the spiracle, a larger triangular one next, and a small triangular one at the top. The metepimeron is broadly yellow, margined all around by black.

The wings are subhyaline with only a trace of brown in the extreme base. Ante- and postnodals are 14–15:9 and 10:10 in fore and hind wings respectively. The triangle of the fore wings is normally two or three celled; the subtriangle, one or two celled (in one specimen on one side three celled). The legs are black, paler at the base, greyish on the inner side of the front femora and tawny of the outer side of the hind femora.

The abdomen is black, broadly overspread with greenish yellow on the side of segment 1 inferiorly, and tawny on sides of 2, on the basal dorsal saddle marks of 2 to 7, and on the sides of 8 and 9. Segment 10 and appendages (text-fig. 2), wholly black.

Female: Length 42 mm.; abdomen 30; hind wing 26. Similar to the male with the black area less extensive, the top of the frons mostly pale, the vertex behind the occelli brown. The two upper spots of the antehumeral pale line are longer and less widely separated. The metepisternal yellow line is broken into but two spots (the three upper ones of the male being conjoined in the female), and the pale marking of the abdomen are more extensive and more yellow, especially on segments 2 and 3 and again on 7, 8 and 9. Segment 10 is black, and the appendages also, except for the extreme tip which is yellow.

The following description of the nymph is drawn in part from the cast skin of the reared specimen, and in part from other nymphs that were collected at the same time with it from the Rio Jicomé.

Nymph (Pl. XX, fig. 5). Length 22 mm.; abdomen 15; hind femur 4; width of head 4; of abdomen 5. In coloration it is dull brownish, with darker and lighter shadings and not much definite pattern; and what pattern there is is often entirely obscured by silt. When cleaned, the anterior parts that are heavily beset with bristles are blackish, and the tarsi are pale yellowish. The pleural shields of the prothorax are darker than the dorsal shield. There is a touch of brown at the nodus of each wing pad, and often there is a dark margin around the wing apex. The lateral margins of the abdominal segments are brown, with pale lateral spines. On the dorsum of the abdomen there are three double rows of diffuse brownish dots, one row submedian, the two others midlateral; and these dots are some times double, or they are short streaks. The caudal appendages are blackish in their basal half, then pale.

The head is of the usual depressed cuneate form, but the antennae (Pl. XX, fig. 5a) are very different from those of other known members of the genus. The third segment is very flat and broad, insomuch that the two antennae together are almost as broad as the head. They are thinly fringed with hairs only on their edges, and besprinkled with hairs as shown in figure 5b. Segment four is a minute subspherical rudiment set like a button on the oblique tip of the third segment. The labium is relatively shorter than in other species. On its prominent middle lobe the scales of the long fringe of the front margin are sparse, slender, and pointed. The lateral lobe at its apex is rounded to a single, minute, terminal tooth (pl. XX, fig. 5d).

The dorsal hooks and lateral spines of the abdomen are rather short thick and blunt as compared with other species. Dorsal hooks on segments 1 to 9 are highest on 2, rapidly descend on 3 and 4 and become longer again on 8 and 9. Lateral spines on 5 to 9 are smaller on 5 and 9, larger on 6 to 8. Segment 9 is a little longer than either 8 or 10, but shorter than the appendages. Of the latter the superior equals the inferiors, with the laterals three fifths as long (pl. XX, fig. 5e).

This nymph is distinguished from all other known nymphs of *Progomphus*, by the extreme flattening of the third antennal segment, the extreme reduction of the fourth segment, by the incomplete upturn of the front tarsi (the claws hardly turn upward), and the minute tooth at the end of the lateral labial lobe.

These differences are so considerable that I thought at first they must indicate a new genus; but the adult proved to be too much like the other two species herein discussed to be separated generically from them: witness the figure of the venation of the reared specimen, and the genitalia of the male.

I was curious to see the armature of the proventriculus and dissected one, which showed in the walls four linear longitudinal chitinized plates, each beset with ten or eleven short, sharp, thornlike, subequal spines.

Progomphus zephyrus new species (Pl. XX, fig. 6.)

In the stream above the mill at Bajo Millo there were some bars of sand and gravel (mostly gravel), and there I went looking for nymphs. With the aid of Mr. Raymondo Alvarez, I found seven of them, two of which were well grown. But they were not the nymphs of *serenus,* nor of *integer,* but represented a new species; and I herewith describe them.

Nymph. Length 19 mm., of abdomen 12; of hind femur 4; width of head 4; of abdomen 5.

Coloration generally obscured by silt, and little developed except on the abdomen, where pattern appears on segments 4 to 9, is ill defined on the anterior segments, and merges at the rear end with the black of segment 10. It differs from *serenus* in having a single row of round midlateral spots each side, and the spots are larger. The spots of the submedian double row are elongated also into oblique streaks in this species. The legs are darker externally where thickly beset with brown hairs, paler at the joints and on the tarsi. The thorax is darkened diffusely in the furrows, and about the borders of the prothoracic shield. The general surface of the skin is prickly-granulose.

Like *serenus,* there are dorsal hooks on abdominal segments 1 to 9 and lateral spines on 5 to 9, but both are more sharply pointed than in that species; less sharply than in *integer.* But the most striking difference is in the form of the antennae. These are strongly flattened on the third segment, and the fourth is an oval rudiment, widest in the middle and hardly as long as segment 3 is wide. These differences are shown in figures 5 and 6 of plate XX: differences in lateral lobe of labium at 5d and 6a.

Type.—Nymph; stream above mill at Bajo Millo, Santo Domingo; June 1940; (J. G. Needham): [Collection of author].

Paratype.—1 nymph; with same data as for type.

II. Two Small Neotropical Species

To the courtesy of Dr. P. P. Calvert I owe the privilege of describing here the nymphal form of two of the small, less typical species of *Progomphus.* One was reared by himself in Costa Rica; the other was obtained from southern Brazil, exuviae and adults from the same collector.

Progomphus longistigma Ris (Pl. XX, fig. 8.)

1916. *Progomphus longistigma* Ris, Archiv f. Naturg., LXXXII, p. 139.

The finding of a nymph of this species in transformation is recorded by Dr. Calvert (1917, p. 395).

Nymph. Length 17 mm.; abdomen 11; hind femur 4; width of head 4; of abdomen 5.

The head is wedge-shaped, of the usual depressed form with a brush of long hairs at each side of the front between the eyes and the antennae. The antennae are strongly convergent forward. The depressed third segment is obliquely flattened, widest toward the base, and densely fringed on its lateral margins with soft wooly upcurving hairs. The fourth segment is not strongly reflexed upon the third, but stands erect in the form of a blunt cone. It is about half as long as the tip of the third is wide.

The hinge of the labrum reaches backward well between the bases of the middle legs. The mentum is about a third longer than wide and is widened slowly forward to the base of the lateral lobes. The middle lobe is a little produced, with a pair of minute brown denticles at its apex. The long marginal scales taper slowly to slender points. The outer margin of the lateral lobe is incurved beyond the moveable hook to a little tooth at the end of the straight inner margin, and before that tooth is a row of about nine serrately-arranged marginal denticles with truncate tips and very small sharp intervening notches (Fig. 8). Under the compound microscope a double line of slender flexuous hairs may be seen extending across the mentum below the level of the bases of the lateral lobes.

The legs are moderately hairy externally. The fore tarsal claws are not reduced and appressed as in the preceding species, but are of the ordinary divergent Gomphine type. The middle coxae are scarcely less approximate at the base than are the front ones. Also the pleural shields of the prothorax are less expanded downward, and the hair fringes on the legs are shorter.

The abdomen is somewhat depressed, almost triquetral, and armed with long and strong dorsal hooks and lateral spines. The dorsal hooks are on segments 2 to 9; longest on 3 and 4, slowly and regularly diminishing in height to 9. The lateral spines are on segments 6 to 9 only, longest on 7 and 8, but only a little smaller on 6 and 9. Segment 9 is a little longer than adjacent segments and the caudal appendages are a little longer than 9. Superior and inferior appendages are about equal in length; laterals, about one fifth shorter.

The above description is from the cast skin of Dr. Calvert's specimen from Costa Rica. It bears the label " Transformed Oct. 16th, 1909 Surubres, C. R. Tristán." It shows no color pattern save for four obscure spots of brown on the posterior declivity of the occiput.

Progomphus lepidus Ris, supposition ·(Pl. XX, fig. 7.)

1911. *Progomphus lepidus* Ris, Mem. Soc. Ent Belg., XIX, pp. 108 and 111, figs. 9, 10.

A number of exuviae, accompanied by adults presumed by the collector, Herr Fritz Plaumann, to be the same species, are the basis of the following description. Adults of two other species of *Progomphus* were collected by Herr Plaumann in the same region, both of these a little larger than *lepidus*. The small size of these nymphs supports the supposition that they belong to that species.

Nymph. Length 18 mm.; abdomen 11; hind femur 4; width of head 5; of abdomen 5.

The exuviae are patternless, or in the darker specimens indistinctly marmorate with brown on the rear of the head, the top of the prothorax and the sides of the abdomen. There are diffuse brownish spots on stigma and nodus of each of the wing sheaths, and darker rings on femora and tibiae beside the knees. The dorsal shield of the prothorax is more bulging than in typical *Progomphus,* and the sides of the pleural shield, less extended downward and clothed with scantier fringe of soft hairs. The outer side of the front tibia is denticulate, and there is little development of the brushes on the outer side of fore and middle legs; also the front tibiae are less twisted than in any of the preceding species; the claws of the front tarsi are not reduced and appressed, but well developed and widely divergent. The hair on each side of the front of the head fringes the margin of a distinctly rounded preocular shelf where it is intermixed with short flat spatulate scales. The antennae (Fig. 7) are rather short with the third segment widest in the middle, flat, oblique, its length but little more than twice its width. Its lateral margins are densely beset with scales (Fig. 7a) that form a marginal fringe about the entire edge of its flat upper surface. The fourth segment is a small supero-terminal subspherical rudiment. Longer tufted hairs project forward from underneath the tip of the third segment. The two short basal segments are nearly bare.

The hinge of the labium extends backward part way between the coxae of the middle legs, which are almost as widely separated as are the fore legs. The mentum is about twice as long as wide; its median lobe is rounded and fringed with long scales that taper to their tips. Subtending these scales is a complete row of a dozen or more low, close-set, broadly rounded, marginal denticles. The lateral lobe is armed with a strong movable hook beyond which the outer margin curves forward to a minute terminal tooth on the inner border, before which on that border there is a straight row of about seven to nine serrately arranged truncate denticles.

The abdomen is moderately depressed, with large blunt dorsal hooks on segments 2 to 9 that slightly increase in length to rearward; that of the 9 projects over the middle of 10; they progressively become laterally flattened. Lateral spines on 6 to 9; on 7 to 9 subequal, on 6 distinctly smaller. The terminal abdominal segments are of about equal length, or 10 may be trifle shorter than 9, and the appendages a trifle longer. Superior and inferior appendages are of about equal length; laterals about half as long.

Irany River, Nova Teutonia, Brazil, 17–18 December.

This nymph approaches *serenus* in the form of the flat third antennal segment but has a heavier fringe of clavate scales around the border of that segment.

III. ANNOTATED LIST OF THE KNOWN NYMPHS OF PROGOMPHUS

1. *Progomphus obscurus* (Rambur), (1842, p. 170). Eastern and Southern United States to Mexico. First figured by Cabot

(1872) on supposition as to specific identity. Cabot's supposition verified by me in 1897 (p. 184). Whole nymph figured by Needham and Hart (1901, p. 95, fig. 3), by Needham and Heywood (1929, p. 62); labium figured by Howe (1923, p. 127) and by Garman (1927, p. 311). Ontogenetic changes in form of nymph are figured by Kennedy, 1921.

2. *Progomphus borealis* Selys, (1873, p. 764). Western States and Mexico. First briefly described by Hagen (1885, p. 275) as "32 Progomphus sp?" from Santiago [San Diego], California." Well described and figured by Kennedy (1917). Account of habits by Seemann (1927). Distinguished from all other species of this list by having lateral spines on abdominal segment 3.

3. *Progomphus alachuensis* Byers, (1939, p. 250). Florida, in sand-bottomed lakes. Briefly described, not figured, by Byers, 1939. Very like the nymph of *obscurus,* but distinguishable by coloration of the abdomen; a double row of longitudinal submedian dashes of brown extended laterally down front and rear margins on the sides of each segment, darkens and fuses to rearward to form a complete ring covering the basal half of the tenth segment. The darkest coloration is low down on the sides in *obscurus,* high on the sides in *alachuensis.* Also the middorsal hooks on the abdomen are of more nearly equal size in *obscurus;* they run quite low and small on the middle segments in *alachuensis.* The exuviae in *obscurus* are nearly without color pattern; those of *alachuensis,* well marked with brown.

4. *Progomphus integer* Selys, (1878, p. 659 *). Cuba, Jamaica, Hispaniola and Trinidad.

5. *Progomphus serenus* Selys, (1878, p. 661 *). Hayti and Santo Domingo.

6. *Progomphus zephyrus* n. sp., Santo Domingo.

7. *Progomphus lepidus* Ris, (1911, p. 111 *). Nova Teutonia, Brazil.

8. *Progomphus longistigma* Ris, (1916, p. 139 *). Costa Rica. Data for these five species (Nos. 4, 5, 6, 7, 8) already presented in the preceding pages.

9. *Progomphus zonatus* Selys, (1854, p. 72 *). (Pl. XX, fig. 9.) Villa Juarez, Tamaulipas, Mexico. Two nymphs in alcohol; one of them well grown, collected by Mr. Lewis Berner on

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* Adults only described.

December 24th, 1939. They were loaned me for study by Dr. C. Byers, with the suggestion that they may be the nymphs of *zonatus* Selys—a suggestion, borne out by their large size and their general structural likeness to the northern species.

10. *Progomphus clendoni* Calvert, (1905, p. 150 *). (Pl. XX, fig. 10.) Mexico. Six nymphs collected by Dr. William D. Sargent and myself on March 1st, 1936 at a place near Victoria where the Arroyo de la Presa crosses the Mexican National Highway in Tamaulipas. Also two additional nymphs, one of which is fully grown, likewise sent me by Dr. Byers, bearing the label: "Rio Chalchalaca, at Puente National Vera Cruz Station, 3/-29/32." Also, a number of young nymphs collected by Dr. P. P. Calvert from the Surubres River in western Costa Rica. An account of the burrowing habits of these nymphs will be found in his "A Year of Costa Rican Natural History," p. 396, 1917. Differs from the preceding species by the characters shown in the table; also by sharper and more decurved tips on the middorsal hooks on the basal abdominal segments; also by its strikingly pretty color pattern. (This however does not show in the youngest of our specimens, and it may be lost from exuviae at transformation.) Size and distributional range indicate that it may be the nymph of *clendoni*, the one remaining known Mexican species of suitable size for which no nymph is yet known or suggested.

11. *Nymph No. 11.* Ceara, Brazil. (Pl. XX, fig. 11.) About thirty nymphs in five separate lots sent me by Dr. R. von Ihering bearing the following survey numbers: 11,421 Acude Bu Soura, 11,428 Acude de Cedro, 11,440 Acude Choro, 11,489 Acude Ema. Unfortunately no corresponding adults have come to hand. The nymphs are very graceful and slender and beautifully patterned in brown. The lateral spines are very slender and sharp; those of segment 7, almost divergent by their tips. The wing pads of one side of a well grown nymph show the venation very clearly, and the following items may some day assist in specific determination. Basal subcostal crossvein present. First and fifth antenodals thickened. Ante and post nodals 12:5/9:6 in fore and hind wing respectively. Five cross veins under the stigma and only three in the apical costal space beyond it. Three cells in the fore wing triangle and two in the hind, and two in both subtriangles.

Two cell rows beyond the forewing triangle for a stretch of ten cells with an extra initial cell. One post anal cell row in the fore wing with two of the cells doubled. The color pattern of the abdomen is shown in figure 11.

12. *Nymph No. 12.* (Pl. XX, fig. 12.) One male nymph from Ceara, Brazil, sent me by Dr. J. von Ihering, bearing the designation "17.245 Acude Coquerina, Fortaleza." Long and slender, similar in form to the preceding and like it with long acuminate and very sharp abdominal appendages that are at least one third longer than the 9th segment. Inside the superior appendage the tips of the fork of the adult male appendage appear at about a third of its length from the base. The dorsal hooks of the middle abdominal segments are slightly lower than those toward the ends, but all are slender and sharp. So also are the lateral spines. The brownish clouds ranged along the sides of the abdomen fuse to rearward to form complete brown rings on segments 9 and 10.

13. *Nymph No. 13.* (Pl. XX, fig. 13.) One male nymph from Ceara, Brazil, included in the same vial with No. 12, and bearing the same data; this also sent by Dr. von Ihering. Very similar to *zephyrus* from Santo Domingo, hereinbefore described. It differs in having no lateral spines on abdominal segment 5. Differs also in coloration of the abdomen, on which a broad middorsal band of brown is composed of four lines of diffuse spots. These by confluence form rough **W**-marks on segments 7, 8 and 9. Lateral to this band there is another row of more distinct roundish brown spots on 4 to 7 or 8. The venation of the developing wings shows one postanal row of single cells in the fore wing. Inside the superior abdominal appendage the forks of the tip of the adult male appendage appear at the three fifths of the distance from the base.

14. *Nymph No. 14.* (Pl. XX, fig. 14.) A single male Venezuelan nymph from Edo Miranda dated May 14th, 1938, given me by Mr. Edgardo Mondolfi. It differs sufficiently from the remainder of this list to merit a little more description.

Length 20 mm.; abdomen 13; hind femur 4; width of head 4; of abdomen 5.

Face pale, darker on the labrum, on antennae, and on the very hairy preocular prominence. Prothorax darkest on the sides and on the lateral margins of the pale dorsal disc. Legs brown, with hind femora and tarsi yellowish except at the ends. Antennae about as shown in figure 6. Abdomen brown, darker on lateral spines and around the dorsal hooks. Segment 10 and base of appendages wholly brown.

Front tibiae with very large external burrowing hooks at the tip, and with long divergent downwardly directed claws.

Dorsal hooks on segments 2 to 9 stout and blunt tipped Lateral spines on 6 to 9, those on 6 and on 9 somewhat smaller than the others. Rather aberrant in this series by the relative shortness of the third antennal segment which is about half as wide as long, by the very strong tibial burrowing hook, by having the middle coxae as far apart as the front ones, by the distinct tooth on the middle of the margin of the median labial lobe and by well developed strong teeth on the inner margin of the lateral lobes. The body is more depressed, the abdomen more triquetral, less cylindrical, the fore legs less twisted and less equipped with hair tract for brushing sand aside, and the nymph is doubtless a less efficient burrower. It is more of the ordinary Gomphine form.

The venation of the wings is well developed in this nymph, and shows the following characters, that may some time aid in identifying it when more of the regional adults are known Antenodal and postnodal crossveins are 16: 10/11: 10 in fore and hind wing respectively, the fifth antenodal is thickened, and a basal half antenodal crossvein is present in both wings. There are about four crossveins under the stigma. All triangles are two celled with two rows of cells in the space beyond, and no extra initial cell in the fore wing, though there is one in the hind wing next the hind angle of the triangle. There is an extra cubito-anal crossvein in the forewing situated half way between the first (*Ac*) and the subtriangle.[4] Behind the base of the anal vein is a single cell row with two of the cells doubled. Beyond the three-celled anal triangle the two postanal interspaces are each filled with two rows of about five cells each, with an extra interpolated cell at the wing margin.

Two species of *Progomphus* are known from Venezuela as adults: *polygonus* Selys and *dorsopallidus* Byers. This nymph is too small to go with the former species, and its venation (in the one pair of wings studied) is inconsistent with the other. The cell row behind the anal vein in the fore wing has four or five cells of its cells doubled in *dorsopallidus*, and the post nodal crossveins are fewer; five to eight. This nymph probably represents a species of which the adult is as yet unknown.

15. *Nymph No. 15.* (Pl. XX, fig. 15.) Guatemala. A single exuvia, "Gualan, Guat., Jan. 16, 1905" given me long ago by E. B. Williamson. It is at once distinguished from all the other species

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[4] This condition is recorded by Ris (1916, p. 140) for the Argentinian species *auropictus.*

of this list by the possession of strong lateral spines on abdominal segments 4 to 9, all large and sharp and of nearly equal size. Dorsal hooks strong, increasing slowly in size and in slant to rearward. The third segment of the antennae is depressed, slightly concave above where covered with long erect hairs.

This nymph is far too large to be assigned to *pygmaeus.* It probably represents an undescribed species.

IV. A Conspectus of the Known Nymphs of the Genus

The nymphs of *Progomphus* that have heretofore been made known all conform to one consistent structural pattern. At the first glance they are marked by a cuneate head, a broadly dome-shaped prothorax, widely divergent wing pads, and a long and gracefully tapering abdomen; most of all, by the very remarkable form of the two forward pairs of legs. These are concave and bare of the inner side where they are closely appressed to the head. The outer side is densely clothed with stiff bristles that curve to rearward and brush the sand aside in burrowing through it.

The front legs are so twisted that the inverted tarsi may be thrust forward quite across the trail, and used to lift the sand in opening a passageway through it. The claws are shortened, thickened, straightened, blunted, and unequal. They are closely appressed and may be directed upward. They have some semblance to the digging claws of a mole. A line of lifting-bristles on the inner edge of the tarsus is continued and supplemented by a little tuft of the same character on the corresponding margin of the lesser claw—a place where no bristles would normally be expected.

The middle legs are swung far forward and held close to the sides of the head, with only their tarsi extended laterally. Their claws are directed outward. Their bases are so closely indrawn that coxae and trochanters are in contact, and bear patches of short contact bristles where they meet on the midventral line. Thus convergent, they have crowded the bases of the fore legs farther apart than usual, with consequent bulging of the sides of the prothorax. Over these bulges there is developed a well chitinized pleural shield each side, which meets the bare dorsal prothoracic shield evenly above, but ends below in a prominent projecting angle. Stiff backwardly curving bristles cover the lateral shield and over-hang its rear margin where they are longest. These streamline the body by covering the hollow sides of the mesothorax. The brushes of bristles on the fore femora externally serve as shields under which the middle legs are moved forward.

The collective results of all this readjustment in form is to give the body slenderness and compactness, and thus to facilitate burrowing. As in burrowing Gomphines generally, the antennae are flattened down against the face and often bear lateral hair fringes. In them are but three well developed segments, with a rudiment of a fourth. That rudiment is much less reduced in *Progomphus* than in other Gomphines, sometimes being about half as long as the third segment. There is also a narrowing of the labium, which together with the indrawing of the first two pairs of legs, moulds the forward part of the body to a more nearly cylindric form: it is more triquetral in other Anisopterous nymphs.

The convex median lobe of the labium is bordered by a double row of microscopic scales, long and short. The scales of the longer upper row are linear and frayed out at the distal end; those of the short supporting, lower row are rounded at the end and entire. The rim from which both rows arise may be heavily chitinized and even moderately toothed.

As is well known, these *Progomphus* nymphs of the typical (*obscurus*) group are the champion burrowers of the Order Odonata. They live in submerged beds of sand; some of them even in the loosely drifting sands of rapid streams. They are the more specialized members of this remarkable genus.

These same species appear to be set apart as adults by (1) The presence of a midventral tubercle on the first abdominal segment; (2) Two rows of basal cells behind the anal vein in the fore wing; (3) Larger cells in the anterior of the two rows of cells beyond the triangle in the fore wing.

There are however smaller species of *Progomphus* in which as adults the tubercle is lacking, the cells of the two rows beyond the fore wing triangle are of practically equal size, and there is a single row of cells behind the anal vein; or at most, but one or two cells in that row may be divided. It has been one of the objects of this study to find out whether the nymphs of these less typical species conform to the type above described. Two nymphs of small species are hereinbefore described and another (no. 14) is included in the preceding annotated list.

In general it may be said that they lack the high degree of specialisation for burrowing deeply in loose sands that is shown by the nymphs of the more typical group as above set forth. They are shorter and stockier of body; less cylindric in cross section at the front; they have the front legs less twisted and less closely appressed to the head, with the tarsal claws equal, strongly curved and divergent; they have the middle coxae much less closely approximated; they have the fourth joint of the antennae much shorter, sometimes even vestigial; and they are in general much more like the nymphs of other Gomphines of comparable size.

The best recognition characters for species are found in the antennae, in the form and armature of the lateral lobes of the labium and in the dorsal hooks and lateral spines of the abdomen. A few species are to be distinguished by their having teeth on the front margin of the middle lobe of the labium: a single median tooth in No. 14; a submedian pair of such teeth in *longistigma;* and an entire border of very blunt teeth (much as in *Erpetogomphus* nymphs) in *lepidus?*

I have endeavored to state the more important of these differences comparatively for the nymphs of all the now known species in the following table.

The table shows lateral abdominal spines on segments 3 to 9 in *borealis* only, 4 to 9 in Nymph No. 15 from Guatemala, 5 to 9 in eight species, 7 to 9 in six species. They would appear on 7 to 9 if the nearly related *Desmogomphus* were included in the table. These spines are easy to see, except that the one on segment 5 is small, appressed, and occasionally even absent in *obscurus.*

Nymphs of some of the smaller species of *Progomphus* very much resemble those of *Erpetogomphus.* Though the species of the typical obscurus group look very different, and seem to differ by the long list of characters given in the preceding pages, as we proceed down our list of fifteen species these differences disappear and finally vanish almost altogether. And apparently it can only be said that *Erpetogomphus* nymphs have a shorter and somewhat wider labium, and relatively longer lateral appendages at the end of the abdomen.

	2	3	4	5	6	7	8	9	10	
Species	Length	Ant. 3 form	Antenna 4			Labium fig.	Abdomen		Color pattern	Distribution
			form	length	fig		hooks	spines		
1. *obscurus*	28	cyl.	cyl.	3	n4	n10	n10	5–9	fig. 1	U. S., Mex.
2. *borealis*	29	cyl.	cyl.	3	n4	n10	2	3–9	0	U. S., Mex.
3. *alachuensis*	30	cyl.	cyl.	3	n4	n10	n2	5–9	3	Florida
4. *integer*	22	oval	cyl.	4	4	n10	n15	5–9	n11	Cuba
5. *serenus*	21	flat	vstg.	1	5	5	n13	5–9	5	Hispaniola
6. *zephyrus*	20	oval	conic	2	6	6	n13	5–9	n13	Hispaniola
7. *lepidus?*	18	flat	vstg.	1	7	n8	7	6–9	0	S. Brazil
8. *longistigma*	17	oval	conic	1	n6	8	n13	6–9	0	Costa Rica
9. *zonatus?*	28	cyl.	conic	2	n4	n10	n15	6–9	9	Mexico
10. *clendoni?*	24	cyl.	conic	2	n4	10	10	5–9	10	Mexico
11. *species?*	20	cyl.	cyl.	4	n4	n10	n2	5–9	11	N. Brazil
12. *species?*	23	cyl.	cyl.	4	n4	n10	n15	5–9	12	N. Brazil
13. *species?*	19	cyl.	conic	1	n6	13	13	6–9	13	N. Brazil
14. *species?*	20	flat	vstg.	2	n6	14	14	6–9	n10	Venezuela
15. *species?*	28	oval	cyl.	5	n4	n10	15	4–9	0	Guatemala

The above table shows the principal characters by which nymphs of these fifteen species of *Progomphus* may be recognized. The abbreviated column headings are to be taken as follows:

Column 2. Length of well grown nymph in millimeters.

Column 3. Third antennal segment: its form, broadly stated; *cyl.*, cylindric; *vstg.*, vestigial.

Columns 4, 5, and 6. Fourth antennal segment: form as before; its length in terms of tenths of the length of the third segment; and a figure reference, respectively. The letter *n* before a numeral means that this species is not figured but that it is most like the one bearing this numeral in the plate; so also, in succeeding columns.

Columns 8 and 9. Abdominal dorsal hooks and lateral spines respectively: in 8, the reference is to figures; in 9 the numbers indicate the segments bearing lateral spines.

Column 10. Dorsum of the abdomen: 0 means pattern wanting in exuviae, which alone (except no. 2) were available for study. Specimens showing the completest development of pigmentation pattern were selected for these diagrams.

Of the fifteen species here listed above, Nos. 1, 2, 3, (U. S. A.), 9, 10 (Mex.), 11, 12 (Brazil), and 15 (Guatemala) clearly belong to the typical obscurus group; Nos. 4, 5, and 6 (West Indian) are nearly allied species, intermediate in size, somewhat less specialized as nymphs, and having the midventral tubercle as adults; but their nymphs are quite diverse in antennal and labial characters. Nos. 7, 10 and 14 are the small species, still more unlike the foregoing and unlike each other.

Nymphs of about half the species of *Progomphus* are still unknown, and additional species that may present new characters doubtless remain to be discovered. The final arrangement of the group awaits more adequate material.

V. THE NYMPH OF THE ALLIED GENUS DESMOGOMPHUS WILLIAMSON

This genus is known from two adult male specimens of a single species, taken at Tiger Creek on the Potaro River near Tumatumari, British Guiana, one on the 5th and the other on the 7th of February, 1912. E. B. Williamson, the discoverer, named it *Desmogomphus tigrivensis* (1920, p. 5). He rightly allied it with *Progomphus,* pointing out two characters that appear to be distinctive of *Desmogomphus:* (1) the middle fork (Mf: first fork in the upper sector of the arculus) is askew forward, and (2) the anterior hamule of the male is broader than the posterior one. He further defined it by the following combination of venational characters: there is no basal subcostal cross-vein; there is no crossvein in either triangle of the fore wing or in the subtriangle of the hind wing, but there is one in the triangle of the latter; there is a basal row of single cells behind the anal vein in the fore wing; there are three post-anal cells in the hind wing, and the stigma is short. To this may be added that of the two interspaces in the anal area of the hind wing the one behind vein A1 is but half the width of the one behind A2; and that the hind angle of the hind wing is so low that in the male it lies nearly opposite the anal crossing.

The exuvia described below was given me by Mr. Williamson some time after his return from British Guiana, but I have not had opportunity to study it until now. It is referred to this genus with some confidence, not alone because it was taken at practically the same time and place with the above mentioned adults, but also because its size corresponds, and so does its degree of divergence from *Progomphus* nymphs. Furthermore there is no other known regional genus to which it may be referred. The nymph may be described as follows:

Nymph. Length 27 mm.; abdomen 18; hind femur 4; width of head 5; of abdomen 6.

Body concolorous (at least, no pattern is discoverable in the cast skin); form stocky, depressed, with the narrowing of the abdomen restricted to the posterior half. Antennae cylindric, the third segment twice as long as the two basal taken together, the fourth a subterminal conical rudiment erected upon the tip of the third, and not longer than the tip of the third is wide. The transverse ridge on the face between the antennae and the eye is densely fringed with soft hair.

The hinge of the labium is between the bases of the middle legs. The elongate mentum (Pl. XX, fig. 16) is strictly parallel sided. Its small median lobe is semicircular and fringed with radiating flat scales. The lateral lobe narrows rather rapidly outward to the base of the movable hook. The length of the latter is twice its distance from the basal hinge of the lateral lobe, and twice the length of the strongly incurving end hook. Proximal to this there is a single large and well defined tooth on the inner margin.

The front tibia is armed externally with a strong burrowing hook; its tarsal claw is long and tapering, ending in a more or less falcate tip. The middle coxae are as wide apart as are the front ones and there is no unusual hairiness of the front legs. There are dorsal hooks on segments 3 to 9 of the abdomen, with a weakly chitinized ridge on 1 and a small hook on 2. The hooks are unusually large and sharp. The lateral spines on only segments 7 to 9 and are nearly equal in size, large and sharp, and that of 9 extends more than half way along segment 10. Segment 9 is dorsally a little longer than either 8 or 10. The appendages are a third longer than segment 9. The superior and inferiors are of equal length; the laterals are a fifth shorter.

Described from a single exuviae bearing the label "From a log in the Potaro River, British Guiana, near Tumatumari, 2/8/12". The specimen is now in the Cornell University collection.

The most marked differences from *Progomphus* are found in the slender antennae, the curiously toothed labium, and the stout lateral spines restricted to segments 7, 8 and 9.

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EXPLANATION OF FIGURES

PLATE XX

Nymphs of *Progomphus* and *Desmogomphus*

The figures are numbered to correspond with the species in the Annotated List (p. 233) and in the Table (p. 241).

Fig. 1.—*Progomphus obscurus.* Color pattern of a deeply pigmented specimen from central North Carolina; 1a, skyline of the abdomen.

Fig. 2.—*Progomphus borealis.* Skyline of the abdomen.

Fig. 3.—*Progomphus alachuensis.* Color pattern of the abdomen.

Fig. 4.—*Progomphus integer.* Antenna.

Fig. 5.—*Progomphus serenus.* Whole nymph, dorsal aspect; 5a, antenna; 5b, hair from the surface of the antenna; 5c, mentum of labium; 5d, end of the lateral lobe of labium; 5e, color pattern of abdomen.

Fig. 6.—*Progomphus zephyrus.* Antenna; 6a, end of lateral lobe of labium.

Fig. 7.—*Progomphus lepidus?* Antenna; 7a, marginal scale from antenna; 7b, skyline of abdomen.

Fig. 8.—*Progomphus longistigma.* Lateral lobe of labium.

Fig. 9.—*Progomphus zonatus?* Color pattern of abdomen.

Fig. 10.—*Progomphus clendoni?* End of lateral lobe of labium; 10a, color pattern of abdomen; 10b, skyline of abdomen.

Fig. 11.—*Progomphus* species? *Nymph No. 11.* Color pattern of abdomen.

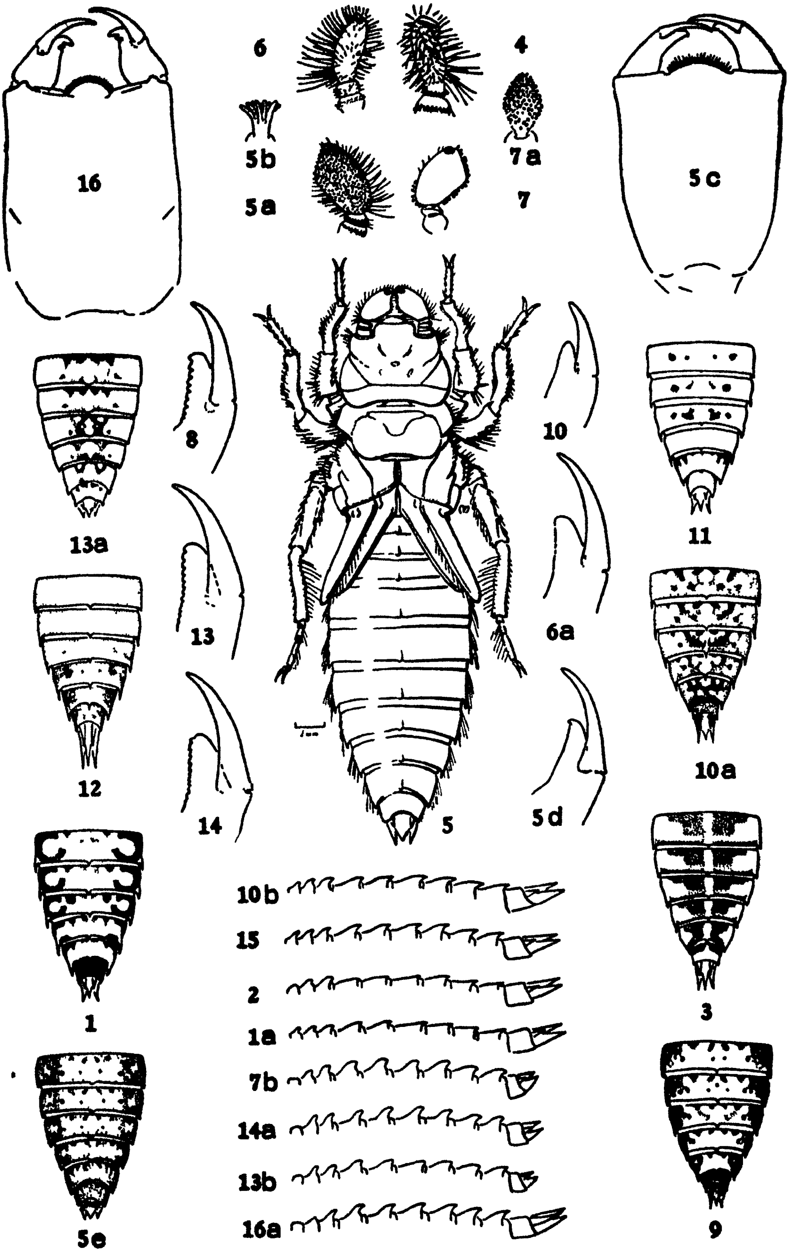
Fig. 12.—*Progomphus* species? *Nymph No. 12.* Color pattern of abdomen.

Fig. 13.—*Progomphus* species? *Nymph No. 13.* End of lateral lobe of labium; 13a, color pattern of abdomen; 13b, skyline of abdomen.

Fig. 14.—*Progomphus* species? *Nymph No. 14.* End of lateral lobe of labium; 14a, skyline of abdomen.

Fig. 15.—*Progomphus* species? *Nymph No. 15.* Skyline of abdomen.

Fig. 16.—*Desmogomphus tigrivensis.* Mentum of labium; 16a, skyline of abdomen.



NEEDHAM—PROGOMPHUS AND DESMOGOMPHUS

NOTES ON AND RECORDS AND DESCRIPTIONS OF ORIENTAL BIRD-LOCUSTS (ACRIDIDAE; CYRTACANTHACRIDINAE)

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(Plates XXI and XXII)

In the preparation of the recently published treatment of the Philippine members of the present group by Rehn and Rehn,[1] it was necessary to assemble much unstudied and unreported material of Old World bird-locusts belonging to the Philadelphia collections, or there for study. The Oriental section of this material was subsequently determined, and this paper presents the results in the way of important notes and records of particular value in more closely defining the ranges of certain of the species, as well as the descriptions of three new forms.

Two hundred and seventy-eight specimens representing fifteen forms of seven genera are here discussed. The greater part (160 specimens) of the material studied is in the collection of the Academy of Natural Sciences of Philadelphia, ninety specimens are in the Hebard Collection there deposited, and smaller lots belong to the United States National Museum and the Buitenzorg Zoological Museum. Certain Chinese series of bird-locusts belonging to the Philadelphia collections have already been reported by Tinkham, and comments are made in the following pages upon certain of his conclusions.

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[1] "The Orthoptera of the Philippine Islands. Part II.—Acrididae; Cyrtacanthacridinae; Group Cyrtacanthacrides." By James A. G. Rehn and John W. H. Rehn. Proc. Acad. Nat. Sci. Phila., xcii, pp. 245–287, text-figs. 1–14, pls 9–10, (1941).

(Issued November 17, 1941)

PACHYACRIS Uvarov

Pachyacris violascens (Walker)

1870. *Acridium violascens* Walker, Catal. Derm. Salt. Brit. Mus., III, p. 587. [♂; Ceylon.]

Uvarov in 1923 stated[2] that he knew of but a single specimen of this species from the Indian mainland (Mysore), although it "seems to be very common in Ceylon." Subsequently he reported a pair of the species from Ibex Hill near Attakatti in the Anaimalai Hills.[3] In the series before me there is a female from Kandy, Ceylon (July, 1909; (E. E. Green)), determined by Uvarov, and also the following:

INDIA: Kodaikanal, Madras Presidency; (C. Leigh); 1 ♂; [Hebard Cln.] Javadi Hills, Madras Presidency, elev. 1500 feet; December 6, 1931; (P. S Nathan); 1 ♂, 1 ♀; [Hebard Cln.].

When compared with the Kandy, Ceylon female, that from the Javadi Hills shows no features which might be considered of subspecific value. The tegminal pattern is essentially the same in the two specimens.

Pachyacris vinosa (Walker)

1870. *Acridium vinosa* Walker, Catal. Derm. Salt. Brit. Mus., III, p. 588. [♀; North Bengal [, India].]

SIAM: Chieng Mai, northern Siam; January 15–March 1, 1933; (De Schauensee-Sinkler Exped.); 2 ♀; [A.N S P.]. Doi Chieng Dao, northern Siam, elev. 4000 feet; January 7–31, 1933; (De Schauensee-Sinkler Exped); 1 ♂, 2 ♀; [A.N.S.P.].

These specimens have been compared with a female in the Hebard Collection from Pakur, Bengal (March, 1906), determined by Uvarov and received in exchange from the British Museum (Natural History). These appear to be the first records of the species from Siam. Tinkham recently reported *vinosa* from Hainan and Kwangtung Province, China.[4]

Pachyacris compressa new species (Pl. XXII, figs. 4–6.)

This species is very closely related to *P. vinosa* (Walker), with the above listed series of which it has been compared. The new form differs in both sexes in the somewhat more compressed form, reflected in the more slender body as a whole, the narrower pronotum as seen from the dorsum and the distinctly narrower head as viewed in cephalic aspect, while the alar organs are more elongate, surpassing the apices of the caudal femora by a distance subequal to the pronotal length, instead of quite definitely less than the same in both sexes of *vinosa.*

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[2] Ann. and Mag. Nat. Hist., (9) XI, p. 478, (1923).
[3] Revue Suisse de Zool., XXXVI, p. 562, (1929).
[4] Lingnan Sci. Journal, XIX, p. 341, (1940).

Type.—♀; Toungoo, Lower Burma. (A. V. B. Crumb.) [Academy of Natural Sciences of Philadelphia, Type no. 5640.]

Size very similar to that of *P. vinosa;* form similar but more slender, the head particularly narrowed more than in *vinosa;* surface sculpture as in *vinosa.*

Head with its normally exposed dorsal length contained nearly four times in greatest pronotal length, as seen in cephalic aspect with greatest width across eyes and across genae contained twice in depth of head, the general outlines in same view nearly straight, very faintly converging dorsad; fastigium in dorsal view with greatest width across ocelli equal to two and one-half times the evident length of the fastigium impressed area, which latter is broad subhexagonal, its greatest breadth slightly greater than its length, the surface subcribrosely impressed; frontal costa broad, the width between antennal bases but faintly less than the least ocular interspace at vertex, the costal width ventrad of the median ocellus slightly less than dorsad of same, but otherwise the lateral costal margins are virtually straight, surface moderately sulcate about and to a decreasing degree ventrad of the median ocellus, deplanate dorsad, the whole strongly cribroso-punctate; lateral facial carinae marked, evenly diverging ventrad of the antennal bases, surface of face and more cephalic and ventral portions of genae rugulosely impresso-punctate. Eyes but moderately prominent when seen from dorsum, in profile with basal outline subreniform ovate, greatest width equal to three-fifths the greatest depth, the greatest width but slightly less than the length of the infra-ocular sulcation (as 15 to 18). Antennae in length slightly surpassing dorsal length of head and pronotum combined.

Pronotum with greatest width of metazonal disk contained approximately one and one-half times in median pronotal length, in profile the dorsal outline is very faintly arcuate, the caudal extremity appreciably upcurved, in transverse section the dorsum of the prozona is slightly tectate, of metazona hardly so, cephalic margin of disk rounded obtuse-angulate, caudal margin of same subrectangulate with the immediate angle rather narrowly rounded; prozona and metazona of subequal length, all three principal sulci definitely but narrowly cutting the median carina; surface of entire pronotum, as usual in the genus, rugulosely and often irregularly cribroso-impressed, in some areas punctately so, in others in a subcicatriform fashion; lateral lobes subquadrate, slightly narrowing ventrad: cephalic margin subsigmoid, ventro-cephalic angle very low obtuse, caudal margin nearly vertical, straight, ventral margin straight and horizontal caudad, slightly oblique cephalad, ventro-caudal angle narrowly rounded rectangulate.

Tegmina when closed surpassing the apex of the caudal femora by a distance subequal to the length of the pronotum, greatest width of tegmen (at proximal fourth) contained slightly more than five and one-half times in tegminal length, distal portion faintly falcate; costal margin with distal half evenly but not strongly arcuate to the rounded rectangulate tegminal apex, distal margin suturad of apex short, oblique arcuato-truncate, sutural margin very faintly sigmoid: greatest width of marginal field (at proximal fourth of tegmen) contained nearly twice in that of discoidal field at distal third of tegmen; mediastine vein evenly paralleling the sigmoidal curve of the humeral trunk, reaching to virtually the apex of the marginal field; areolation of the tegmina as a whole relatively close in the proximal half, much more open and with subquadrate areolets distad. Wings reaching to the tegminal apices when in repose, greatest width contained slightly more than twice in the alar length.

Prosternal process erect, slender, acute, appreciably compressed at base, apex in profile not at all recurved and on axis of caudal margin, but with cephalic outline gently arcuate distad to the same. Interspace between mesosternal lobes reversed cuneate, its greatest cephalic width slightly less than the median length of the interspace (as 19 to 22), internal margins of lobes nearly straight convergent caudad, the least width between the lobes (caudad) equal to half the cephalic width, caudo-internal angles of lobes rounded acute, caudal margin of lobes nearly transverse, very shallowly concave. Metasternal lobes with margins strongly arcuate mesad and meso-caudad, the least interspace between the lobes equal to half that between the outer borders of the foramina, caudo-lateral margin of the metasternal lobes nearly straight oblique. Ovipositor valves definitely compressed, deep, apices of both pairs moderately recurved; lateral plate of ventral ovipositor valves short and deep, the apex rectangulate, the dorsal and caudal borders broadly arcuate. Ultimate sternite (subgenital plate) transversely subtruncate laterad, mesad with triangular production acute and extending caudad between the ventral ovipositor valves for nearly half this length.

Cephalic and median limbs of normal length but relatively slender, femora straight. Caudal femora moderately compressed, relatively deep in proximal half, the maximum depth contained four and one-half times in the greatest femoral length, external pagina relatively flat but quite sharply although not deeply sculptured, medio-dorsal carina appreciably serrate with intercalated serrulations, usually three each between the serrations, dorso-external carina pauciserrate; genicular lobes with length distad of axis of proximal end of genicular arch nearly twice the depth of the lobe from its dorsal bordering impression (as 3.6 to 2), distal margin of lobes with dorsal portion obliquely declivent to the broadly rounded apex: caudal tibiae compressed, with internal spines (11) definitely longer and heavier than external (7), the discrepancy most pronounced mesad, least evident distad.

Allotype.—♂; same data as type. [Academy of Natural Sciences of Philadelphia.]

Differing from the description of the female (type) in the following noteworthy features.

Size much smaller than that of female, head proportionately not as much narrowed as in that sex; surface sculpture similar.

Head with its normally exposed dorsal length contained two and two-thirds times in greatest pronotal length, as seen in cephalic aspect with width across eyes contained nearly one and two-fifths times in the greatest depth of head, that across genae one and three-fifths times in the head depth, genal outlines in cephalic aspect quite straight, vertical; fastigium with greatest width across ocelli equal to twice the evident length of the fastigial impressed area, which latter while subhexagonal is definitely narrower than in the female, its greatest breadth faintly less than its length, the surface somewhat more deeply subcribrosely impressed than in the female: frontal costa essentially as in female but width between antennal bases very slightly greater than the least interocular interspace at vertex. Eyes proportionately more prominent and subbullate when seen from dorsum, in profile with basal outline broad ovate, the greatest width equal to thirteen-twentieths of the greatest depth, while the length of the infra-ocular sulcation is but four-fifths the width of the eye outline (as 12 to 15). Antennae approximately twice as long as the dorsum of the pronotum.

Pronotum definitely more compressed and as a whole less expanding caudad than in the female, although the metazona expands as sharply as in the latter, greatest width of metazonal disk contained slightly more than one and three-fifths times in the median pronotal length (as 34 to 56); caudal margin of pronotal disk rectangulate with the immediate angle very narrowly rounded when compared with that of the female; prozona on median line very faintly longer than metazona (as 28 to 26); lateral lobes as in female.

Tegmina in relative length as in female, but slightly narrower, with greatest width (at proximal fourth) contained five and three-fourth times in tegminal length, apex slightly more rounded than in female, sutural margin straighter. Wings with proportions as in female.

Interspace between mesosternal lobes narrower than in female, its greatest cephalic width contained one and one-third times in the median length of the interspace (as 11 to 15), internal margins of lobes rather concavely convergent, the least width between the lobes (caudad) slightly less than half the cephalic width (as 5 to 11), caudo-internal angles of lobes as a whole more sharply acute and with the immediate apices more narrowly rounded, caudal margin of lobes more oblique and more definitely concave than in female. Metasternal lobes subcontiguous caudad, otherwise as in female. Ultimate tergite (supra-anal plate) elongate subtrigonal, its lateral margins nearly straight converging to distal fifth where a definite rectangulate marginal shoulder is present, the marginal apex of the tergite rounded rectangulate; surface of ultimate tergite with distad converging broad lateral concavities reaching to the marginal shoulder, the lateral margins appreciably cingulate and the mid-rib of the tergite roundly elevated, broadening proximad and there with a medio-longitudinal impression, while the apical extremity has its surface impresso-punctate. Cerci elongate, styliform, tapering, apex acuminate, subsigmoid in lateral view, from dorsum the distal third is seen to be inbent at less than a 45° angle, apices of cerci reaching distad as far as those of the broad but acutely angled infra-cercal plates. Ultimate sternite (subgenital plate) acuminate, its dorsal margins as seen in profile in large part concave, dorsal surface of sternite distad of anal orifice concavely deplanate with a pair of distad converging low carinulae, apex definitely acute in dorsal view.

Caudal femora with greatest depth contained four and one-fifth times in greatest femoral length, medio-dorsal carina with intercalated serrulations fewer or absent, while the serrulations of the dorso-external carina are more evident and more numerous.

Coloration.—General tone of dorsum of pronotum, most of lateral lobes of same and the greater part of the head except the genae, between hay's russet and liver brown (of Ridgway); genae, occasionally occiput, and pleura ranging from tawny-olive to clay color. Tegmina with base tone ochraceous-tawny, with an obscure overlaid wash pattern of maculae of small size, arranged roughly in obliquely transverse series, these more evident in distal half of tegmina than in the more proximal section, and approaching bister in tone. Wings with disk variably, but never strongly, washed proximad with rose, occasionally absent (allotypic male), remainder of wings very weakly washed with fuscous, principal veins in this area pencilled more strongly with same. Eyes mars brown to tawny. Antennae of the pale base color proximad, darkening distad to the darker one. Limbs as a whole of the color of the pleura in the female, somewhat darker in the male, the external pagina of the caudal femora rather conspicuously pale, the paginal pattern usually well pencilled in the darker tone; dorsal surface of caudal femora obscurely (female) or definitely (male) trifasciate transversely with prout's brown, the distal one genicular and in the male extending ventrad of the genicular arches and suffusing the proximal half of the genicular lobes, most of the latter (female) or distal half alone ochraceous-buff to buckthorn brown; caudal tibiae russet-vinaceous to seal brown, paler proximad, spines with distal faces and apices black, base yellowish; caudal tarsi vinaceous-brown to seal brown.

Measurements.—♂ (allotype): length of body, 36.2 mm.; length of pronotum, 8.9; length of tegmen, 33.5; length of caudal femur, 18.9.

♀ (type): length of body, 51 mm.; length of pronotum, 13.85; length of tegmen, 50.5; length of caudal femur, 30.

In addition to the type and allotype I have before me a paratypic male and two paratypic females, bearing the same data as the type. The coloration of one female has been largely destroyed, but in the others this has been well preserved, and the range of tones observed has been noted in the color descriptions. In size the paratypes closely agree with the measured type and allotype.

SCHISTOCERCA Stål

Schistocerca gregaria (Forskål)

1775. *Gryllus gregarius* Forskål, Descr. Animal. Itin. Orient. Observ., p. 81. [Arabia Felix; Yemen; Egypt.]

While a great amount of information is available on the Desert Locust, exact occurrence localities are still of value in mapping the full area over which this exceedingly destructive species may occur.

Syria: Ras-el-Mein, Lebanon, elev. 2200 feet; April 21, 1930; (W. B. Evans); 1 ♂; [A.N.S.P.].

Palestine: Dead Sea; (R. W. Wehrle); 3 ♂, 2 ♀; [A.N.S.P.].

India: Mussoorie, Dehra Dun, United Provinces, elev. 5700 feet; July 14–27, 1930; 4 ♂; [Hebard Cln.].

All of these specimens are representative of the swarming phase of the species, which in addition is before me from a number of other less noteworthy localities.

ANACRIDIUM Uvarov

Anacridium flavescens (Fabricius)

1793. [*Gryllus*] *flavescens* Fabricius, Entom. Syst., ii, p. 52. [Tranquebar [, southern India].]

Uvarov[5] has given the differential features of this species and summarized its distribution as known to him. While not extending the species' range outside of southern India, the material now before me supplies more exact records than all previous information.

Southern India: Kistna District, northern Madras; August, 1922; 1 ♀; [Hebard Cln.]. Salem, Salem District; September 15, 1934; (P. S. Nathan); 3 ♂, 1 ♀; [Hebard Cln. and A.N.S.P.]. Shevaroy Hills, Salem District, elev. 2000–4000 ft.; September 11, 1934; (P. S. Nathan); 2 ♂, 2 ♀; [Hebard Cln.]. Coonoor, Nilgiris District, elev. 5000 ft.; May 19, 1923; (P. S. Nathan); 1 ♂; [Hebard Cln.]. Coimbatore, Coimbatore District; 1922; 1 ♂; [Hebard Cln.]: August, 1921 and 1922; (P. S. Nathan and A. P. Nathan); 2 ♀; [Hebard Cln. and A.N.S.P.]. Trichinopoly, Trichinopoly District; August, 1921; (C. Leigh); 1 ♂; [Hebard Cln.]. Muganjur; January 26, 1931; (P. S. Nathan); 1 ♂; [Hebard Cln.]. Nedungadu; May 10 and July 23, 1932; (P. S. Nathan; male (May) attracted to light); 1 ♂, 1 ♀; [Hebard Cln.]. Shembaganur, Madura; 1922; (F. Anglade); 1 ♀; [Hebard Cln.].

This series shows that over and above the rather subdued and not strongly pronounced pattern, the general color tone varies in its impression as a whole from umber brown to a dull ashy gray, which latter is distinctly yellowish, as if by an overwash, in a Coimbatore male and that from Coonoor. The largest female is that from Nedungadu (length of tegmen, 72 mm.), the smallest one of the two from the Shevaroy Hills (length of tegmen, 62 mm.), the other from the latter locality virtually intermediate between these (length of tegmen, 68 mm.).

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[5] Ann. and Mag. Nat. Hist., (9) xi, pp. 488–489, (1923).

Anacridium deschauenseei[6] new species

(Pl. XXI, figs. 1–2; pl. XXII, fig. 3.)

This is the largest form of this genus of striking locusts, in bulk equalling some of the smaller forms of the Neotropical Tropidacres. On one hand it is related to the south Indian *A. flavescens,* and on the other it approaches the north African and Mediterranean *A. aegyptium,* with ample series of both of which it has been compared. From both, however, it differs in its much greater size, the much more strongly tectate pronotum, and in the groove sulcation of the fastigium being carried continuously ventro-cephalad over the dorsal portion of the frontal costa to the median ocellus. When compared with *A. acgyptium,*[7] with which *deschauenseei* agrees in the definite inter-antennal broadening of the frontal costa, the latter is seen to differ also from the former, and agree with *flavescens,* in the obtuse, instead of acute, caudal angle of the pronotal disk, and in the much deeper and more spatuliform genicular lobes of the caudal femora. When the male sex is known possibly we will find it has genitalic differences.

Exactly what relationship, if any, this species may have to the genus *Adramita* Uvarov,[8] of southern Arabia, remains to be determined when the male of *deschauenseei* is known. When compared with the description and figure of the female type of *Anacridium arabicum* Uvarov, on which *Adramita* is based, many differences are apparent, as the larger size of the present species, the proportionately longer alar appendages, the lower pronotal crest, the but in part infuscate wings, as well as numerous other color differences. The wholly infuscate wings and the male genitalic features of *Adramita* are considered by Uvarov to be the generic criteria.

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[6] Dedicated to Mr. Rodolphe Meyer de Schauensee, Vice-President and Curator of Birds of the Academy of Natural Sciences of Philadelphia, who collected the unique type of this large and striking species.

[7] The series of *A. aegyptium* before me consists of the following: Hyeres, France; 1♀; [A.N.S.P. ex Saussure]. Valencia, Spain; 2♂, 1♀; [Hebard Cln.]. Portici, Italy; February, 1917; (C. Menozzi); 1♂, 1♀; [Hebard Cln.]. Sambiase, Calabria, Italy; June, 1921; (C. Menozzi); 2♀; [Hebard Cln.]. Sicily; 1♂; [A.N.S.P. ex Saussure]. Lesina, Dalmatia; April 3, 1913; (R. Ebner); 1♂; [A.N.S.P.]. Lac Misserghin, Algeria; 1889; (Desbrochers); 1♀; [Hebard Cln.]. Egypt; 1♀; [A.N.S.P. ex Saussure]. Ras-el-Mein, Lebanon, Syria; June 10, 1931; (W. B. Evans); 1♀; [A.N.S.P.]. Teheran, Persia, elev. 3800 feet; April 13, 1929; (David Williamson); 1♂, 1♀; [Hebard Cln.]. Elburz Mountains near Teheran, Persia, elev. 5000 feet; December 18, 1929; (David Williamson); 1♀; [Hebard Cln.]. Elburz Mountains near Teheran, Persia, elev. 6500–8500 feet; June 27 to August 3, 1929; (David Williamson); 1♂, 1♀; [Hebard Cln.].

[8] Journ. Linn. Soc. London, Zool., xxxix, p. 547, (1936). Genotype: *Anacridium arabicum* Uvarov, Ann. and Mag. Nat. Hist., (10) vi, p. 186, (1930). [♀; Qara Mts., Gurthunat, central southern Arabia.]

Willemse's *Anacridium javanicum*[9] I know only from its very unsatisfactory original description, which except for the measurements is based on color features of a single female, said to have been pinned after alcoholic preservation. The species is said to have a uniformly smoky wing, " without dark fascia, reddish at the base," which, together with its distinctly smaller size (tegmen, 54 mm.), would at once remove it from consideration in connection with *deschauenseei*. The pronotum of *javanicum* is said to be "without stripes or spots," the "elytra with some faint markings in the apical half," while the caudal tibiae are said to be "brown, spines brown with black tips." All of these features are at variance with *deschauenseei*, the only question being how much they have been caused by the wet preservation of the unique type of *javanicum*.

Type.—♀; Chieng Mai, northern Siam. March 17, 1929. (De Schauensee-Smith Siamese Expedition, 1928; R. M. de Schauensee.) [Academy of Natural Sciences of Philadelphia, Type no. 5639.]

Size very large (for genus); form moderately attenuate, appreciably compressed.

Head with greatest width across eyes subequal to the length of the metazona of the pronotum and to the depth of the head to the supra-clypeal suture; occiput convex, appreciably declivent cephalad to the interocular space, which latter is faintly broader than half the greatest width of the fastigium including the lateral ocelli (as 13 to 25), juxta-ocular portions of interocular space and adjacent latero-caudal borders of the fastigium strongly bevelled toward the eyes; fastigium with its evident length cephalad of least interocular space, as seen from dorsum, subequal to the interocular width, surface of fastigium rather deeply excavate medio-longitudinally, extending caudad to and ending at the interocular space, the arcuate bordering and converging lateral margins extending caudad from the lateral ocelli, the excavate area roughly vase-shaped, and the impression continued cephalad more shallowly but definitely to the frontal costa without delimitation, in profile the fastigio-facial angle is hardly indicated, the passage from fastigial to facial line being rather broadly arcuate; frontal costa relatively broad and subampliate between the antennal bases, evenly narrowing ventrad of the median ocellus and thence subequal in width to clypeal suture, greatest width between antennal bases appreciably greater than interocular width (as 16 to 13), a slight but definite median sulcation continued from the fastigium to the median ocellus, deeply sulcate about and to a decreasing degree ventrad of the same, the surface of the whole frontal costa, but less strongly so about the median ocellus, impresso-punctulate: lateral facial carinae markedly elevated, appreciably diverging in ventral three-fifths. Eyes moderately prominent in dorsal view, in profile with basal outline ovate, greatest width contained slightly more than one and one-half times in depth of outline, infra-ocular sulcus slightly shorter than eye depth. Antennae in length slightly surpassing the combined dorsal length of head and pronotum.

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[9] Ann. Soc. Entom. France, CI, p. 143, (1932). [♀; Pradjekan, Java.]

Pronotum slightly strangulate mesad, this accentuated in appearance by the tectation of the dorsum, greatest width across metazonal dorsum equal to nearly three-fourths the greatest pronotal length (as 75 to 105), the greatest width across prozona but slightly more than half the pronotal length (as 59 to 105); cephalic margin as seen from dorsum broadly but definitely obtuse-angulate, the converging sections of the margin slightly concave, immediate angle but slightly rounded, caudal margin definitely but not greatly more obtuse than a right angle, immediate angle rather narrowly rounded; metazona slightly longer than the prozona (as 50 to 55), all three transverse sulci deeply but rather narrowly impressed; in profile the pronotal crest is relatively pronounced, quite markedly arcuate longitudinally, in transverse section the pronotal dorsum is markedly tectate and quite strongly so on the prozona: lateral lobes with their greatest depth subequal to their dorsal length, cephalic and caudal margins appreciably but not markedly sinuate convergent ventrad, ventro-cephalic angle obtuse, ventro-caudal angle rounded rectangulate, ventral margin subsinuate, slightly ascending in cephalic half: surface of metazona, with lateral lobes of same, closely ruguloso-cribrose, of prozona equally rugulose but less cribrosely impressed.

Tegmina when closed surpassing the apices of the caudal femora by a distance but slightly less than twice the dorsal length of the pronotum, in shape having proximal half of average width but with distal portion subfalcately recurved and evenly narrowing, greatest median width contained slightly less than six times in the tegminal length, that at distal sixth contained eight times in the same length: costal margin in proximal half nearly straight, in distal third increasingly arcuate to the well rounded apex, distal margin narrow, strongly oblique arcuate, sutural margin faintly sinuate, subconcave in distal half, subconvex in proximal one; marginal field at broadest point equal to one-third of the greatest tegminal width, slightly wider than greatest breadth of anal field; mediastine vein definitely paralleling the humeral trunk and reaching to the extremity of the marginal field, intercalated area definitely wider than ulnar area, as 19 to 15, areolation of proximal half of tegmina as a whole dense and involved. Wings when closed reaching to the tegminal apices, narrow, greatest alar width contained two and a fifth times in the alar length, apical section moderately attenuate, immediate apex proportionately as wide as tegminal apex and of the same shape; costal margin quite strongly arcuate in distal fourth.

Prosternum with process moderately compressed at base, as seen from the venter weakly bulbose distad, in profile moderately recurved, its cephalic outline oblique proximad, oblique arcuate distad, apex itself bluntly acute, the latter separated by a considerable interval from the mesosternum. Interval between mesosternal lobes relatively narrow, sublongitudinal, rectangulate, its width equal to eight-elevenths of its greatest length, internal margins of lobes straight, subparallel, caudal margins of lobes transverse subtruncate, meso-caudal angle narrowly rounded rectangulate. Metasternal lobes briefly subcontiguous caudad of the foveolar area, the extreme caudal portion of the margin of the lobes quite sharply arcuate to their straight oblique lateral margins. Ultimate tergite (supra-anal plate) relatively short scutellate, its apex rectangulate, hardly surpassing apices of infra-cercal plates, converging lateral margins sinuately arcuate, the whole strongly arcuate transverse, median transverse impression marked, medio-longitudinal portion of surface subdeplanate, without median sulcation. Cerci styliform, concavely tapering to the blunt acute apices, seen from dorsum cerci are not at all incurved. Ovipositor jaws moderately slender, in profile with apices of both valves quite strongly arcuate, in fact almost hooked, spaced transverse rugulae of dorsal surface of dorsal valves evident, particularly the nine proximal ones, dorso-external margins of same rather irregularly crenulate; ventral valves with ventro-external tooth stout and sublamellate, lateral plate on same valves deep, apically acute, its dorsal margin straight proximad passing to oblique subarcuate distad. Ultimate sternite with median production of distal margin acute, strongly concavely emarginate about the base of each ventral ovipositor jaw.

Cephalic and median limbs relatively short. Caudal femora in length equal to slightly less than half that of the tegmen, greatest femoral depth contained four and two-thirds times in their length, the spaced low serrulations of the medio-dorsal and the dorso-lateral carinae distinct, pattern of external pagina sharply but not deeply etched, genicular lobes deep, virtually spatuliform, their length distad of the axis of the proximal base of the genicular arch to the greatest depth of the lobe from its dorsal bounding impression as 35 to 21, distal margin of lobes strongly arcuate: caudal tibiae with eight external and eleven internal spines, the latter as usual somewhat the longer.

Coloration.—General base tone clay color to buckthorn brown, lightening to dull ochraceous-buff on the pleura and with the pagina of the caudal femora as light as pale ochraceous-buff. Darker markings, vermiculations and cloudings of pronotum, tegmina and pleura ranging from cinnamon-brown to mummy brown. Head clay color with a tawny tinge; antennae ferruginous proximad, paling to clay color distad; eyes dark auburn. Pronotum with crest washed with mummy brown caudad on the prozona and cephalad on the metazona, caudal margin of pronotum beaded with eight blotches of mummy brown, with indefinite and pale cloudings of the same extending weakly over the metazonal disk, prozona in the postocular region with several short and broken elements of dark barring, weak quadrate darker markings on the lateral lobes immediately cephalad of the principal sulcus and weak continuations of the pattern of the discal metazona indicated on the metazonal lateral lobes. Tegmina with an atomaceous sprinkling of prout's brown to mummy brown, heavier in the intercalated area than elsewhere, but distributed with no semblance of pattern. Wings with narrow disk pale naples yellow, a broad arcuate band, in greatest width equal to slightly more than two-fifths of the tegminal length and extending proximad over the whole of the anterior field to the base of the wing, almost solidly mummy brown, more opaque along the veins, apex of wing clear hyaline with scattered quadrate areolar maculae of dresden brown. Abdomen with a vermiculate over-mottling of dresden brown. Caudal femora with dorsal surface not at all solidly but definitely transversely trifasciate with dresden brown to mummy brown, the latter tone pronounced on the carinae, ventro-external carina lengthily beaded with mummy brown, genicular arches bister, the extreme base of the genicular lobes more weakly washed with the same, remainder of these lobes naples yellow: caudal tibiae hair brown (Ridgway), spines with basal half ferruginous, apical half and line on distal side to base black, tarsi hair brown.

Measurements.—Length of body, 81.5 mm.; length of pronotum, 16; greatest width of metazonal disk of pronotum, 11.5; length of tegmen, 82; length of caudal femur, 37.5.

The type of this most striking species is unique.

VALANGA Uvarov

Valanga nigricornis melanocornis (Serville)

1839. *Acridium melanocorne* Serville, Hist. Nat. Ins., Orth., p. 659. [♂, ♀; Java.]

In addition to material of this form already reported by Rehn and Rehn[10] I have seen the following:

Java: Buitenzorg; July 3, 1912; 1 ♀; [Buitenzorg Zool. Mus.] Tjibodas; January 1900; 1 ♂; [Buitenzorg Zool. Mus.]. Poerwodadi; March 1913; 2 ♂, 3 ♀; [Buitenzorg Zool. Mus. and A.N.S.P.]. Goenong Salak; December 1900; 2 ♀; [Buitenzorg Zool. Mus.]. Bogor; 2 ♀; [A.N.S.P.].

The Bogor females represent the extremes of dichromatism seen in this species, one having the head, pronotum and tegmina in general rather uniform wood brown, the other with a marked dorsal medio-longitudinal line of yellow from the fastigium to the anal area of the tegmina, with the discoidal field of the latter more definitely multimaculate with dark brown.

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[10] Proc. Acad. Nat. Sci. Phila., XCII, p. 265, footnote 42, (1941).

Valanga nigricornis waiensis new subspecies (Pl. XXII, figs. 1 and 2.)

This striking form is more nearly related to its nearest geographic allies, i.e. *n. sumatrensis* Uvarov, of Sumatra; *n. insularis* Williamse, of the Mentawei Islands; and *n. nigricornis* (Burmeister), of Singapore, than it is to any of the other subspecies of this plastic species. From all three subspecies mentioned the new form differs in the blackish purple color of the extensor surface of the caudal tibiae, from both *n. nigricornis* and *n. sumatrensis* in the non-infumate and more uniformly pale tone of the lateral lobes of the pronotum, and from *n. nigricornis* and *n. insularis* in the usually weak and at most incomplete character of the dark dorsal transverse bars on the caudal femora. In addition it differs from *n. sumatrensis* in the presence of a proximal blackish lineation on the ventro-external carina of the caudal femora, and from *n. insularis*[11] in the general green instead of brown coloration, but this may be due to the presence of dichromatism in the new form, which, however, is not known as yet to occur, and also from the same form by the restriction of the pronotal blackish areas to paired dorsal ones separated by the definitely broader medio-longitudinal pale line and the sharp definition of these laterad on the dorsal portion of the lateral lobes. The latter condition may be discounted as a differential one if dichromatism is found to occur in either *n. insularis* or *n. waiensis*.

The dorsal profile of the prozona of the pronotum is more definitely arcuate in *V. n. waiensis* than it is in any of the three forms with which it has been compared except *n. sumatrensis,* to which this is very similar, but while this arcuation is indicated in all five specimens seen of *n. waiensis* it may, from what we know of certain other forms of the genus such as *V. gohieri,* prove to be an individual feature.

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[11] *Valanga nigricornis insularis* Willemse, Journ. Malayan Br. Royal Asiat. Soc., VI, p. 6, pl. III, fig. 2, (1928). [♀ (type), ♂; Sipora Island (type locality); Pulau Tello, Batu Islands, off west coast of Sumatra.]

This clearly has as a synonym the following:

Valanga nigricornis batuensis Sjöstedt, Arkiv för Zoologi, 23A, no. 4, pp. 5, 10, fig. 1, (1931). [♀; Batu Islands.]

Whether this form is limited to Wai Island or occurs as well in extreme northwestern Sumatra remains to be determined. The material of *V. n. sumatrensis* and of *n. nigricornis* used for comparison has already been recorded.[12]

Type.—♂; Sabang, Wai Island, off northwestern point of Sumatra, Dutch East Indies. July 3, 1939. (E. R. Helwig.) [Academy of Natural Sciences of Philadelphia, Type no. 5636.]

General structural features essentially as in *V. nigricornis sumatrensis*, with pronotum much nearer to that form in its bullation and moderate arcuation of dorsal outline than it is to what is seen in *V. n. melanocornis*, the following structural details being worthy of comment in their differences.

Fastigium slightly more transverse than in *n. sumatrensis* as seen from dorsum, the lateral margins cephalad of the lateral ocelli more sharply concave-convergent to the fastigial passage into the frontal costa, which in profile is as nearly arcuate as in *n. sumatrensis*, the width of the frontal costa at the fastigio-facial juncture slightly narrower than in *n. sumatrensis;* sculpture of frontal costa, and emphasis and outline of eyes as in *n. sumatrensis.*

Pronotum with the median carina, its emphasis, moderate tectation and prozonal low curvature essentially as in *n. sumatrensis*, the transverse incisions of the sulci, however, less emphasized, narrower and shallower.

Tegmina surpassing the apices of the caudal femora by a distance subequal to the pronotal length.

Prosternal spine similar in shape and length to that of *V. n. sumatrensis* but more slender and of less longitudinal extent. Genital features as in *n. sumatrensis* except that the ultimate sternite (subgenital plate) is slightly less acuminate produced.

Cephalic and median limbs slightly shorter than in *V. n. sumatrensis.* Caudal femora slightly more slender and proportionately shallower than in *V. n. sumatrensis*, genicular lobes with distal margin more broadly arcuate.

Coloration.—All the material seen of this form is in the phase which Rehn and Rehn in a recent analysis of *Valanga* color types[13] have called the "striped" phase. Pale base color citron yellow, areally becoming amber yellow, sometimes washed on the face and caudad on the lateral lobes of the pronotum with dull green yellow. Dorsum with the paired dark areas on the pronotum blackish fuscous, occupying all or nearly all of the dorsum of the same laterad of the median pale line, sharply delimited laterad and not extending over the lateral lobes save for a few puncta or small maculations dorsad and without cloud involvement, the depth of the infuscation and the degree of its solidity caudad, in the neighborhood of the caudal margin of the disk, varying somewhat individually, weakest in the type. Head with the dark postocular bars, which are continuous with the pronotal discal dark areas, evident but of variable strength and solidity, quite weak in the type, continued cephalad dorsad of the eyes and laterad in the fastigial margins as narrow pencillings. Eyes prout's brown. Antennae with immediately proximal articles of the pale base color, passing to olivaceous black which colors the entire remainder. Lateral lobes of pronotum pale, with at most a few regularly placed caudal marginal dottings and a few similar ones dorsad on the prozonal section. Tegmina of the general color with a very weak proximal infuscation of the humeral trunk. Wings with basal portion pale carmine, the remainder distinctly but not opaquely infuscate with cinnamon-brown, the veins strongly pencilled, both vein lining and membrane wash gradually passing into the basal carmine. Cephalic and median limbs with the distal extremity of the femora clouded more or less definitely with darker. Caudal femora with dorsal and ventral external carinae, and also the paginal pattern less completely, pencilled with dusky dull green, the lining of the ventral external carina relatively heavy, dorsal surface with indications of variable strength (least evident in the type) of two transverse bars of dusky dull green, never solid and most pronounced on the carinae; genicular arches blackish fuscous, genicular lobes clear primuline yellow; caudal tibiae with flexor surface old gold to dull citrine, paling distad, extensor and lateral surfaces slate purple to raisin black, darkest proximad on extensor surface, paling distad to dragon's-blood red to brick red, which also washes the dorsal surface of the caudal tarsi, tibial spines zinc orange, black tipped. Abdomen with dorsal surface indefinitely and rather obscurely infuscate, proximal tergite definitely tinted with pale carmine.

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[12] Rehn and Rehn, Proc. Acad. Nat. Sci. Phila., XCII, p. 265, footnotes 41 and 42, (1941).

[13] Proc. Acad. Nat. Sci. Phila., XCII, pp. 259–260, (1941).

Measurements (in millimeters)

	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur
♂, type	48	11	45	25.5
♂, paratype	44.5	10.8	41	24
♂, paratype	47	11.1	45	25.5
♂, paratype	45.2	11.1	41.3	25.5
♂, paratype	46.2	11.2	44	26.1

In addition to the type I have before me four paratypic males bearing the same data as the type. Except for the slight size range shown by the above measurements these specimens differ from the type only in a greater intensity of the dark pattern, the palest extreme represented by the type, the more intense extreme with the dorsal pronotal areas more sharply limited and deeper in tone, and the femoral dark lining and barring more pronounced.

Valanga gohieri gohieri (Le Guillon)
1841. *Acridium gohieri* Le Guillon, Revue de Zool., 1841, p. 295. [Vavao, Amboina [, Moluccas].]

Although this name was erected many decades previous to Uvarov's *Valanga nigricornis conspersa*,[14] Sjöstedt, in raising to that rank the species-group including it, overlooked the fact that *gohieri* dated from Le Guillon, 1841, and used *conspersa* as the nominate form,[15] erroneously crediting *gohieri* to Uvarov, doubtless by inadvertence taking it from the latter's comprehensive revision of the Old World bird locusts.[16] This is, of course, not in accordance with the chronological sequence of the names, as *gohieri* must be considered the key form, that name having been proposed eighty-two years before *conspersa* was described.

The series here reported have been referred to *g. gohieri* only after considerable study. It is evident that this form not only exhibits a range in color phases and patterns which suggests that recently discussed by Rehn and Rehn in *Valanga nigricornis moro*,[17] but has in addition a definite fluctuation in the depth of tone of the red of the caudal tibiae, with which apparently at times is correlated that of the proximal portion of the tibial spines, these accordingly becoming in some individuals as pale as orange yellow. At the same time there is appreciable variation in series as to whether the ventro-external carina of the caudal femora is with or without blue-black puncta, and also whether the cephalic and median femora are immaculate or with similar blue-black puncta. While not proposing the establishment of synonymy, which requires the supporting evidence of larger and more perfectly preserved series before doing so, I feel the present representation definitely suggests that *V. g. conspersa* Uvarov[14] and *V. g. badjanica* Sjöstedt[18] may have been based on purely individual variants of *g. gohieri*, which form is now known to be present over the general area from which these other subspecies were described.

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[14] Ann. and Mag. Nat. Hist., (9) XII, pp. 348, 355, (1923). [♂ (type), ♀; Island of Waigiou, northwest of New Guinea.]

[15] Arkiv för Zoologi, 23A, no. 4, pp. 3, 6, 15 and 16, (1931).

[16] Ann. and Mag. Nat. Hist., (9) XII, pp. 349, 355, (1923).

[17] Proc. Acad. Nat. Sci. Phila., XCII, pp. 261, 264, text-figs. 2, 8, 12 and 14, pl. 9, fig. 17, pl. 10, figs. 20 and 21, (1941).

[18] *Valanga conspersa badjanica* Sjöstedt, Arkiv för Zoologi, 23A, no. 4, pp. 3, 7, 16, (1931). [♂, ♀; Badjan (Batchian) [, Moluccas].]

In addition the series here reported shows conclusively that there exists in this form appreciable plasticity in the exact profile outline of the dorsum of the prozona of the pronotum. In one extreme condition this definitely approaches the form seen in *V. g. disparilis* (Kirby), from Christmas Island, a paratypic female of which, received in exchange from the British Museum (Natural History), is now before me. The following records amplify our knowledge of this form.[19]

AMBOINA: 1900; 1♂; [Buitenzorg Zool. Mus.].

BOEROE (Buru): March 1917, April 1917, July (also specifically 20 and 23) 1913; 2♂, 6♀; [Buitenzorg Zool. Mus. and A.N.S.P.].

CERAM: Wahai; July 20, 1917; 2♀; [Buitenzorg Zool. Mus. and A.N.S.P.]. South Ceram; 1915; 1♂; [A.N.S.P.]. East Ceram; February 1910; 1♂, 2♀; [Buitenzorg Zool. Mus. and A.N.S.P.].

DUTCH NEW GUINEA: Hollandia; 1910 and May 15, 1911; 1♂, 3♀; [Buitenzorg Zool. Mus. and A.N.S.P.]. No exact locality; 1♀; [Hebard Cln.].

As to these representations that from Boeroe shows a broad range in color tone and pattern, from one extreme having a quite pale yellowish base color with strongly contrasted blackish lateral patches on the prozonal dorsum, immaculate cephalic and median femora, almost no blue-black puncta on any of the external carinae of the caudal femora, and with the caudal tibial spines with their bases orange-red, to an opposite extreme with the base color definitely dull ochraceous, the prozonal blackish patches extending incompletely caudad over the metazona as lateral bordering lines to the pale median line, while the cephalic and median femora remain immaculate, at most but few blue-black puncta are present on the ventro-external carina of the caudal femora, the caudal tibial spines, however, with their bases solidly red with the tibiae. The profile of the prozona ranges in the Boeroe females from straight to quite appreciably arcuate.

The Ceram specimens show much the same variational range as those from Boeroe, the base color being as pale in one male, but the prozonal dark areas are more broken up into linear series, heavier and more complete laterad, sometimes extending on the metazona as lines flanking the pale median bar. The cephalic and median femora may be immaculate or with a limited number of blue-black puncta, while the ventro-external carina of the caudal femora usually has a number of similar puncta, rarely quite a regular series. The Ceram individuals show less tendency toward prozonal bullation than in those from Boeroe, but a single one having the outline at all definitely arcuate.

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[19] In addition to the specimens here listed, which are clearly referable to *V. g. gohieri*, I have seen a considerable series of specimens of the genus from various of the Lesser Sunda Islands and of the Moluccas, which due to their collection in liquid preservation and subsequent drying have lost most, if not all, of their original coloration, and the chitin of these has also buckled and shrivelled to a degree which makes them useless for critical work. These I will not attempt to assign specifically.

Of the reported Dutch New Guinea series but a single female has its original coloration preserved to any marked extent, and this (the one lacking an exact locality) has the bases of the spines on the caudal tibiae orange-red. In but one female of the New Guinea series is any arcuation of the prozonal profile at all evident, the others having it virtually straight.

PATANGA Uvarov

Patanga luteicornis (Serville)

1839. *Acridium luteicorne* Serville, Hist. Nat. Ins., Orth., p. 658. [♂, ♀; Java.]

North Borneo: Sandakan; (C. F. Baker); 1 ♀; [Hebard Cln.]. Mohari; 2 ♀; [Buitenzorg Zool. Mus. and A.N.S.P.].

This beautiful species ranges from Penang in the Malay Peninsula across Sumatra (with Nias) and Java to northern Borneo.

Patanga japonica (I. Bolívar)

1898. *Acridium japonicum* I. Bolívar, Ann. Mus. Civ. Stor. Nat. Genova, xxxix, p. 98. [♂, ♀; Yokohama [, Japan].]

China: Shanghai, Kiang Su Prov.; October 19, 1919; (E. Suenson); 1 ♀; [Hebard Cln.]. Soo Chow, Kiang Su Prov.; May 5, 1918, October 12, 1919; (E. Suenson); 1 ♂, 4 ♀; [Hebard Cln.]. Che Kiang Prov.; June 6, 1920; (E. Suenson); 1 ♂; [Hebard Cln.]. Mountains near Foo Chow, Fu Kien Prov., elev. 2500 feet (on one specimen); July 26 and September 23, 1921; (C. R. Kellogg); 1 ♂, 1 ♀; [Hebard Cln.].

India: Kurseong, Sikkim; 1920 (in part); (C. Leigh); 17 ♂, 9 ♀; [Hebard Cln. and A.N.S.P.]. Champaran, Kurseong district, Sikkim; April, 1925; (J. Andreas); 1 ♀; [Hebard Cln.].

These specimens have been compared with a series of male and female topotypes from Yokohama in the Academy series. As in the topotypic series certain individuals of both sexes lack, with a greater or lesser clarity, the dark median longitudinal dividing bar in the pale area on the lateral lobes of the pronotum. This is completely lacking in the Shanghai female and also in one Kurseong male, and subobsolete in another from the latter locality. Rarely the lower pale section is completely obscured by extension of the dark infuscation normally margining it ventrad, although in these cases the more dorsal pale bar is distinct and sharp. The pair from mountains near Foo Chow and two of the Soo Chow females have all the pale lateral areas on the pronotal lobes subobsolete, although in the latter the pale medio-longitudinal bar is marked on the head, pronotum and anal area of the tegmina. The pair from mountains near Foo Chow are as a whole dark and dull, being season-end individuals with frazzled tegminal and wing apices.[20]

In the Kurseong males the base of the wing disk ranges from uncolored hyaline to suffused with rose. This series shows a moderate size range in both sexes, but not enough to cause any difficulty in the recognition of the species. Apparently Sjöstedt's variety *immaculata*[21] is based upon hyaline-winged individuals with reduced tegminal maculation. These features, as well as the varied pattern of the lateral lobes of the pronotum, occur independent of one another, and the erection of varietal names for these serves no useful purpose.

Patanga succincta (Johannson)

1763. *Gryllus succinctus* Johannson, Amoen. Acad., VI, p. 398. [Java.]

As said by Uvarov in 1923[22] the exact range of this species is very incompletely known, and the following localities are recorded to assist in more exactly defining the distribution of the species.

INDIA: Kodaikanal, Palni Hills, Madras Presidency; (C. Leigh); 2 ♂, 1 ♀; [Hebard Cln.]. Salem, Salem district, Madras Presidency; September 4, 1934; (P. S. Nathan); 1 ♂; [Hebard Cln.]. Shambaganur, Madura; 1923; (F. Anglade); 3 ♂, 1 ♀; [Hebard Cln.].

JAVA: Soekaboemi; July, 1919; 1 ♀; [Hebard Cln.]. Buitenzorg; October 2, 1920; 1 ♀; [Buitenzorg Zool. Mus.]

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[20] See Tinkham, Lingnan Science Journal, XIX, pp. 343–344, (1940).

[21] *Patanga japonica* var. *immaculata* Sjöstedt Arkiv för Zoologi; 25A, no. 3, p. 32, (1933). [♂, ♀; Mountains near Chiu-Chiu-kai, Kia-ling-ho River, northeast Sze-chuan, China.]

[22] Ann. and Mag. Nat. Hist., (9) XII, p. 367, (1923).

CYRTACANTHACRIS Walker

Cyrtacanthacris tatarica (Linnaeus)

1758. [*Gryllus* (*Locusta*)] *tatarica* Linnaeus, Syst. Nat., X ed., p. 432. [Tataria.]

Uvarov[23] has carefully studied the very involved and confused synonymy of this insect, and the erroneous interpretations of the specific name which fill the literature.

India: Kurseong, Sikkim; (C. Leigh); 3♀; [Hebard Cln.]. Nilgiri Hills, Madras Presidency; 1922; (A. P. Nathan); 1♀; [Hebard Cln.]. Coimbatore, Madras Presidency; 1921, January 27, 1921, October, 1921; (A. P. Nathan); 4♂, 4♀; [Hebard Cln. and A.N.S.P.]. Trichinopoly, Madras Presidency; August, 1921; (C. Leigh); 1♀; [Hebard Cln.]. Palni Hills, Madura, elev. 5000 feet; 1♀; [Hebard Cln.]. Shembaganur, Madura; 1922; (F. Anglade); 1♂, 3♀; [Hebard Cln.]. Mugaiyur, South India; April 24, 1931; (P. S. Nathan); 1♂, 1♀; [Hebard Cln.]. Chepat Polur, South India; April 16, 1931; (P. S. Nathan); 1♂, 1♀; [Hebard Cln.].

Burma: Yenangyaung, elev. 600 feet; August 25, 1937; 1♂, 2♀; [A.N.S.P.]. Toungoo, Lower Burma; (A. V. B. Crumb); 1♂, 5♀; [A.N.S.P.].

Siam: Chieng Mai, North Siam; March 15, 1926; (R. M. de Schauensee); 1♂; [A.N.S.P.]: January 15–March 1, 1933; (De Schauensee-Sinkler Expedition); 26♂, 22♀, 2 imm. ♀; [A.N.S.P.]. Doi Chieng Dao, North Siam, elev. 4000 feet; January 7–21, 1933; (De Schauensee-Sinkler Expedition); 8♂, 6♀, 1 immature ♂, 4 immature ♀; [A.N.S.P.].

CHONDRACRIS Uvarov

Chondracris rosea rosea (DeGeer)

1773. *Acrydium roseum* DeGeer, Mém. l'Hist. Ins., III, p. 488, pl. 41, fig. 1. [China.]

Of the typical form of this species the following material is before me, a portion of which has already been reported by Tinkham.[24]

China: Peiping, Pe Chili Prov.; September 9, 1932; (C. Ho); 1♀; [A.N.S.P.]. Mt. Omei, Sze Chuan Prov., elev. 2500 feet; August 10, 1929; (C. D. Graham); 1♂, 1♀; [Hebard Cln.].[27] Foo Chow, Fu Kien Prov.; August 31, 1921; (C. R. Kellogg); 1♂; [Hebard Cln.].[27] Canton, Kwang Tung Prov.; September 10, 1918, September 19–30, 1921, November 15, 1918; (C. W. Howard); 9♂, 6♀; [Hebard Cln. and A.N.S.P.].

It is evident that the typical form of the species differs from subspecies *brunneri* in the definitely lower, flatter pronotal profile, as emphasized by Uvarov,[25] although, as I am discussing under *C. r. brunneri,* the tegminal length difference pointed out by him has no significance or value other than as a purely individual feature. The caudal margin of the pronotal disk averages definitely obtuse-angulate in *r. rosea* rather than rectangulate, although the Canton males show some plasticity in this respect. Further the males of *r. rosea* have the cephalic and median femora definitely more bulbously inflated than in *C. r. brunneri.*

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[23] Ann. and Mag. Nat. Hist., (9) XIV, p. 96, (1924).

[24] Lingnan Sci. Journal, XIX, p. 340, (1940).

In the six Canton females the development and arcuation of the pronotal medio-dorsal carina varies appreciably from as low and as little arcuate as in the single Mt. Omei female, to a definitely more elevated and low arcuate type, nearly as divergent in this respect as the Formosan male discussed below. Clearly *C. r. rosea* is beginning to show instability in south China in the degree of pronotal arcuation.

A single male in the Hebard Collection from the Koshun District of Formosa (February) has its pronotal profile as arcuate as in Burmese and Siamese individuals of that sex here considered *C. r. brunneri,* but the caudal angle of its pronotum is slightly broader than a rectangle and the cephalic and median femora are as definitely inflated as in Canton males. In consequence I feel it should be considered atypical *C. r. rosea.* Uvarov,[26] from Shiraki's figure of Formosan material, considered *rosea* from that island to be *C. r. rosea,* but Tinkham[27] seemed to feel otherwise. With a considerable series of both subspecies before me, I have reached the conclusion expressed above relative to this Formosan individual.

While the males of *C. r. rosea* before me show some little size variation they are relatively uniform compared with the females. The Canton individuals of the latter sex range in size between the following extremes: length of body, 69.5–83.5 mm.; length of pronotum, 16–21; length of tegmen, 56–71; length of caudal femur, 34–44.

The Peiping record is apparently the most northern for the species.

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[25] Ann. and Mag. Nat. Hist., (9) XIV, p. 108, (1924).
[26] Ann. and Mag. Nat. Hist., (9) XIV, p. 108, (1924).
[27] Lingnan Sci. Journal, XIX, p. 340, (1940).

Chondracris rosea brunneri Uvarov

1924. *Chondracris rosea brunneri* Uvarov, Ann. and Mag. Nat. Hist., (9) XIV, p. 108. [♂, ♀ (type); Java (type locality); Samarang and Buitenzorg, Java; Assam, Silhet and Calcutta, India; Amboina,[28] Moluccas.]

INDIA: Khasi Hills, Assam, elev. 4000 feet; November, 1930; 1 ♂, 1 ♀; [Hebard Cln.]. Mussoorie, Dehra Dun, United Provinces; September 21, 1930; 1 ♀; [Hebard Cln.].

BURMA: Toungoo, Lower Burma; (A. V. B. Crumb); 6 ♂, 6 ♀; [A.N.S.P.].

SIAM: Doi Chieng Dao, North Siam, elev. 4000 feet; January 7–21, 1933; (De Schauensee-Sinkler Expedition); 2 ♀; [A.N.S.P.]. Trong, Lower Siam; part labelled January–February, 1899; (W. L. Abbott); 5 ♂, 12 ♀; [U.S.N.M., A.N.S.P. and Hebard Cln.].

JAVA: Buitenzorg; 2 ♀; [Buitenzorg Zool. Mus. and A.N.S.P.].

The Mussoorie female and that from the Khasi Hills are virtually typical of *C. r. brunneri* in the arcuation of the pronotal crest, although the caudal margin of the pronotal disk in the former is broader than a rectangle. The Khasi Hills male has the cephalic and median femora quite appreciably more inflated than in the Toungoo series, and the caudal margin of the pronotal disk is also less acute than in any of the six Toungoo males. It seems best to consider the Assam material and that from the Himalayan front (Mussoorie) as atypical of *r. brunneri*. The Doi Chieng Dao females show that in the hills of northern Siam the representation is clearly *r. brunneri*, and the Toungoo series, as well as that from Trong, are similarly *r. brunneri*, showing only such fluctuations in size, exact pronotal cristation and degree of angulation of the caudal margin of the disk of the same as is seen in any fair-sized series of either form of the species.

Southward there is an average increase in size in *C. r. brunneri*, especially in the females, but the range at any one locality is considerable, although not as great as the Canton extremes of *C. r. rosea* measured above. The extremes of the Trong females and the two Buitenzorg females measure (in millimeters) as follows:

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[28] I cannot help but query the latter locality, which is so far to the eastward of any other point at which forms of this species, or genus, have been taken. Amboina in the past century and more served as the entry port for a considerable part of the commerce of the Netherlands Indies, so it is always possible material so labelled may have originated much to the westward.

	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur
Trong, Siam	74	20	66.5	38
" "	83	21.6	70.5	40.5
Buitenzorg, Java	80	23.8	73.5	42
" "	85.5	24	79	45

A structural fluctuation noticed only in this subspecies is in the extent of lateral bullation of the tectate pronotal crest, particularly on the prozona. This is exceedingly pronounced in one of the Buitenzorg females (the smaller one), very definite but less emphasized in one of the Toungoo females, and faintly evident in several of the same sex from Trong, one of the Doi Chieng Dao females and that from Mussoorie. I have seen no evidence of this in males, and very probably it is a purely individual variation, although it may occur only in the female sex. It is, however, not correlated with any more marked arcuation of the pronotal profile, which, while varying somewhat, is entirely independent in this respect of the presence or absence of this bullation.

The Mussoorie female apparently extends the range of this subspecies, and incidentally the species, somewhat to the westward. Uvarov in 1924 gave Calcutta as the most western locality known to him, but has since reported this subspecies from the Anaimalai Hills of southern India.[29]

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[29] Revue Suisse de Zoologie, xxxvi, p. 563, (1929).

EXPLANATION OF FIGURES

PLATE XXI

Fig. 1.—*Anacridium deschauenseei* new species. Male (type). Chieng Mai, northern Siam. Dorsal view. (Natural size)

Fig. 2.—*Anacridium deschauenseei* new species. Male (type). Chieng Mai, northern Siam. Lateral view. (Natural size)

PLATE XXII

Fig. 1.—*Valanga nigricornis waiensis* new subspecies. Male (type). Sabang, Wai Island, Dutch East Indies. Dorsal view. (Natural size.)

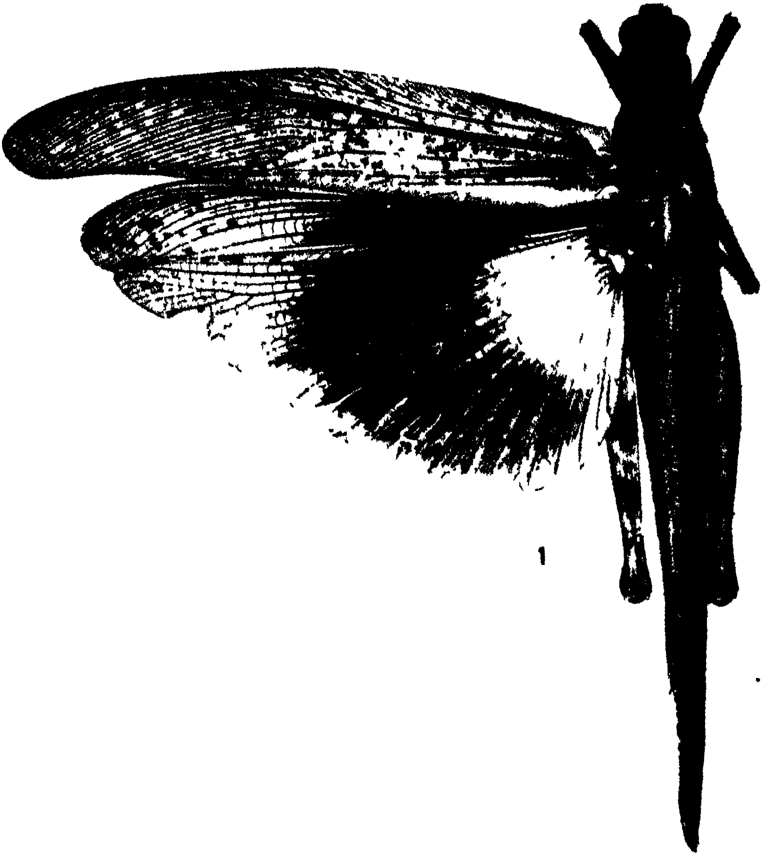
Fig. 2—*Valanga nigricornis waiensis* new subspecies. Male (type). Sabang, Wai Island, Dutch East Indies. Lateral view. (Natural size.)

Fig. 3.—*Anacridium deschauenseei* new species Male (type). Chieng Mai, northern Siam. Cephalic view of head (Natural size.)

Fig. 4—*Pachyacris compressa* new species Male (allotype). Toungoo, Burma. Dorsal view (× 2)

Fig. 5.—*Pachyacris compressa* new species. Male (allotype) Toungoo, Burma. Lateral view (Natural size)

Fig. 6.—*Pachyacris compressa* new species. Female (type). Toungoo, Burma. Dorsal view (× 2)



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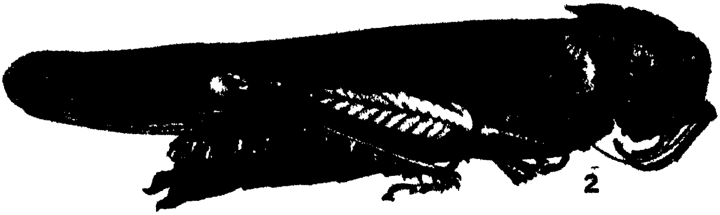

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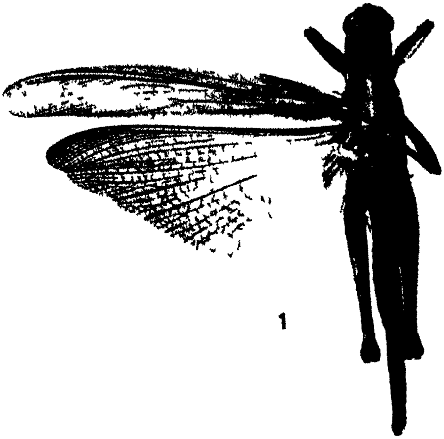
REHN—ORIENTAL BIRD-LOCUSTS



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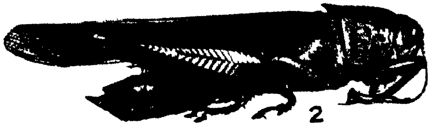

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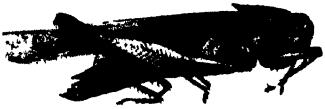

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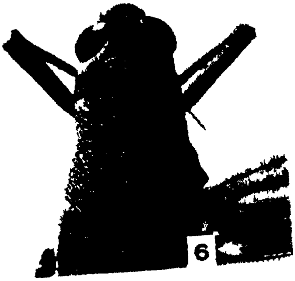

6

REHN—ORIENTAL BIRD LOCUSTS

A NEW SPECIES OF METALECTRA FROM EASTERN NORTH AMERICA

(LEPIDOPTERA: PHALAENIDAE)

BY A. E. BROWER

Augusta, Maine

(Text-figures)

A *Metalectra* which seemed to be new was found three years ago in Massachusetts material being determined for the Boston Society of Natural History. Not wishing to base a new species on a single specimen, I awaited the accumulation of more material. Recently I learned that Dr. A. G. Richards, Jr. was describing a new *Metalectra* from Florida. I wrote at once and suggested that he examine the Massachusetts material and if the same include the specimens in his type series and if not describe it as an additional new species. He replied that his description of *M. albilinea* from Florida was ready to appear [1] and that he had already made slides of Massachusetts males and of a single female from Georgia which might be the same or an additional species and had found both distinct from *albilinea*. He suggested that I accept the specimens, slides, and drawings he had of this section of the genus *Metalectra* and describe the new species. This was done after sending all of my material to him for examination. In July 1941, Dr. F. M. Jones, who has collected all of the Massachusetts specimens, secured females along with more males on Martha's Vineyard. Slides of these females agree with the genitalia of the Georgia female collected by Richards.

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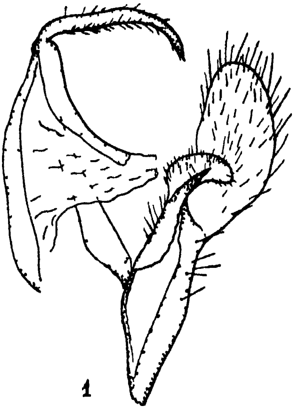
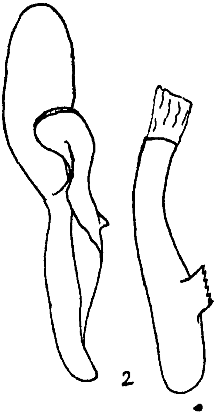
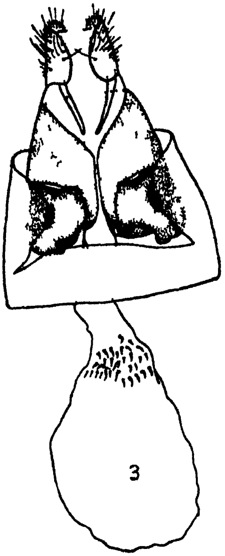
[1] A new species of *Metalectra* from Florida (Lepidoptera: Phalaenidae). By A. Glenn Richards, Jr. *American Museum Novitates,* no. 1115, June 3, 1941.

Issued November 28, 1941







Text-fig 1—*Metalectra richardsi* new species Male genitalia of holotype Fig 2—Truly mesal view of left harpe of paratype male, July 28, (aedeagus drawn alongside at same magnification) Fig 3—Ventral view of female genitalia of allotype

Metalectra richardsi, new species

In both size and markings this species is most like the North American species *miserulata* and *albilinea.* From *miserulata* it may be known by its considerably smaller size, paler more prominently marked secondaries, straighter more prominent median shade, less prominent reniform, much brighter rusty-brown scaling (brownish black on *miserulata*), and the genitalia. From *albilinea* this species is widely distinct according to Dr. Richards. He gives the following differences: (1) area between reniform and t. p. line not or only slightly reddish in this in contrast with *albilinea;* (2) red-brown subterminal area, gray-brown on *albilinea;* (3) stronger black median line; (4) more or less checkered fringe; (5) more maculate hind wing; and (6) by the different genitalia of both sexes. He called my attention to the fact that the accessory cell of the fore wing may be well-developed, partly developed, or entirely absent in this species.

Sexes alike. Head dark slaty or blackish gray with a few scattered reddish or brownish scales in the frons; antennae dark gray, with the enlarged base ringed with white proximally and distally, the basal half with the inner row of scales on each segment shorter and contrasting blacker (on one male proximal portion entirely black above) but becoming less contrasting and grayer toward the tip; palpi whitish scaled within and beneath, the outside heavily overlain with fuscous scales, second segment whitish at tip and third whitish at base and tip, becoming gray when worn. Thorax clothed with broad dark slaty scales, posterior tuft concolorous. Legs gray and brownish white, the femur, tibia and tarsi all with light apices, and all tibiae usually with a median light band. Fore wings reddish rusty to dark tile-brown, shaded with fuscous; basal dash scarcely evident, apparently joining the dark basal half-line which is edged with white outwardly; transverse anterior line fairly prominent, double, dark without and white within, produced inward on radius, cubitus and anal veins; dark median shade evident to prominent, angled outward in the cell; transverse posterior line black but not conspicuous, strongly bowed outward to M_1, then nearly erect to M_3, then diagonally inward to the fold, then erect to inner margin except for a tooth on A_2; subterminal line of connected prominent white scallops; terminal line of fairly prominent black scallops. Reniform scarcely defined, a vertical patch of dark scales overlain by rusty brown scales; orbicular an evident dark patch; about eight small white patches along costa, most prominent on outer side of t. p. and s. t. lines, and also at inner margin on these; the rusty red-brown scaling is strongly developed in the subterminal area, less so elsewhere with variable numbers of fuscous scales. Hind wings grayish with three incomplete indistinct transverse black lines from inner margin, one across the middle, one before and another just after the anal angle, all broadened on the inner margin, the last with whitish spots before and after; outer margin with a scalloped black line. Beneath the wings are pale gray; fore wings with dark costal spots opposite median and t. p. lines, these lines and the whitish s. t. line evident on some specimens and a few whitish costal spots as well; hind wings with the three black lines evident, a black scalloped terminal line and discal spot. The fringes are evidently but not prominently checkered, rusty and whitish scales separating dark patches The abdomen blackish, with segments 1, 2, 3 and 4 partly ringed with white distally or with a few whitish dorsal scales; 5 and 6 dark, 7 all white or nearly white, 8 whitish to grayish, whitish gray beneath; harpes grayish above with whitish setae on sides. Some specimens with less white on abdomen.

Expanse: Both sexes very uniform in size, 15–16 mm.

Male Genitalia (6 slides, Figs. 1–2). As figured but the clasper (on the harpe) on Fig. 1 is twisted, the full mesal view showing it even more rounded and broader than on Fig. 2 (The usual ventral view is unsatisfactory for comparison with closely related species.); harpes and claspers of the two sides alike. The closest species in size and maculation, *miserulata* and *albilinea,* have narrower more pointed harpes; and the clasper is excavated apically on *miserulata,* the ventral lobe being somewhat the largest, while *albilinea* lacks the excavation but has the ventral lobe considerably produced.

Female Genitalia (3 slides, Fig. 3). The female genitalia are quite unlike any North American species known to the author. The large prominent pockets are distinctive, one on each side beyond the opening to the bursa. These pockets are partly closed ventrally by projecting flaps but are open inwardly on the depressed area before the bursal opening. In the figure the proximal flaps are turned back partly out of position. The lateral flaps have prominent terminal areas of large scent scales (readily lost in preparation). *M. praecisalis* has much simpler pouch-like depressions in the same position; the other species examined lacking them.

Holotype.—♂; Martha's Vineyard, Massachusetts; (F. M. Jones); July 28, 1941; [Academy of Natural Sciences of Philadelphia, no.].

Allotype.—♀; Martha's Vineyard, Massachusetts; (F. M. Jones); July 26, 1941; [United States National Museum Collection].

Paratypes.—7 ♂, 4 ♀. The males are all from Martha's Vineyard, Massachusetts, F. M. Jones, dated July 8, 11, 13, 19, 22, 24 and 28, 1931 to 1941 (one bears a Vineyard Haven label). Three females Martha's Vineyard, Massachusetts, July 22, 24 and 25, 1941, F. M. Jones. One female, Clarke County, Georgia, August 9, 1929, A. G. Richards, Jr.

The male paratype from the Boston Society of Natural History is labelled "Vineyard Haven, Mass., July 24, F. M. Jones" and will be returned. Part of the others will go to various museums, with specimens in the collections of: A. E. Brower, A. G. Richards, Jr. and F. M. Jones. Named for A. G. Richards, Jr. who first collected and studied it.

I am indebted to Dr. Richards for the loan of additional specimens of *miserulata,* his Georgia female of *richardsi,* his slides and drawings in this section of Metalectra, and for comparisons and critical notes. Dr. F. M. Jones has been most helpful in collecting and supplying additional material. The figures given were all made, altered, or finished by the author and responsibility for their accuracy is his.

DISTRIBUTIONAL NOTES AND KEYS TO AMERICAN DITOMYIINAE, DIADOCIDIINAE AND CEROPLATINAE WITH DESCRIPTIONS OF NEW SPECIES[1]

(DIPTERA: MYCETOPHILIDAE)

BY ELIZABETH G. FISHER

Research Associate, The Academy of Natural Sciences of Philadelphia

(Plates XXIII and XXIV)

This paper deals with the distribution of three subfamilies of Mycetophilidae, the Ditomyiinae, the Diadocidiinae, and the Ceroplatinae (excluding the genera *Platyura* of authors and *Asindulum* which I hope to discuss in another paper). The nearctic fauna only is treated except in the genus *Ceroplatus* where a new species of the neotropical fauna is described and the neotropical species are assigned to subgenera. Descriptions of previously described subfamilies, genera, subgenera, and species (except in two cases) are not given but references to the original description and to other important papers are listed. The known distribution is given. The male terminalia are figured where available; *Platyura pectoralis, Symmerus dilutus* and *Ceroplatus fasciatus fenestralis* being the only nearctic species previously figured.

In the distribution records below, the collector's name, when known, is placed in round brackets ( ), the authority of a published record and the date of publication in square brackets [ ]. The location of the specimens in the various collections is indicated by one of the following abbreviations: A.L.M.—Private collection of Dr. A. L. Melander, New York City. A.N.S.P.—The Academy of Natural Sciences of Philadelphia. B.S.N.H.—Collection of the Boston Society of Natural History in the New England Museum

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[1] Many of the figures and some of the keys presented in this paper are from a portion of my unpublished thesis presented to Cornell University.

(Issued December 8, 1941)

of Natural History, Boston. C.A.S.—Collection of the California Academy of Sciences at San Francisco. C.B.D.G.—Private collection of Mr. C. B. D. Garrett, Cranbrook, British Columbia. C.U.—Cornell University Collection at Ithaca, New York. M.C.Z. —Museum of Comparative Zoology at Harvard University. O.A.J. —Private collection of Dr. O. A. Johannsen, Ithaca, New York. U.S.N.M.—United States National Museum, Washington, D. C.

Where no mention is made of the "type" it is understood that the species was originally described from Europe. An * indicates I have not seen the specimen or specimens on which the record is based, all others I have examined. There are additional specimens in the Cornell University Collection and in the private collection of Dr. Frank Shaw at Amherst, Massachusetts which I have examined but of which I have only incomplete data; these have therefore not been included except where they noticeably extend the range.

I am greatly indebted to Dr. A. L. Melander for allowing The Academy of Natural Sciences of Philadelphia to retain the types and a share of the paratypes of several of the new species described in this paper, as well as other specimens.

I also wish to thank the following for the privilege of examining the collections in their care: Dr. Nathan Banks, Museum of Comparative Zoology at Harvard. Drs. E. A. Chapin and Alan Stone, United States National Museum. Dr. Richard Dow, The Boston Society of Natural History. Dr. O. A. Johannsen, Cornell University. I also wish to thank this Academy and especially Mr. E. T. Cresson, Jr. for unending aid in many ways.

Subfamily DITOMYIINAE

Mycetobiinae Winnertz, Verh. Zool.-bot. Ges. Wien., XIII, p. 666, 1863. Johannsen, Maine Agr. Exp. Sta. Bull., no. 172, pp. 222–228, figs. 80–81, 1910.

Ditomyidae Keilin, Ann. Mag. Nat. Hist., (9), III, pp. 33–40, 1919.

Ditomyinae Edwards, Ann. Mag. Nat. Hist., (9), VII, pp. 431–433, 1921. Edwards, Trans. Ent. Soc. London, 1924, pp. 509–512, fig. 181, 1925.

The old subfamily name *Mycetobiinae* was changed to the *Ditomyinae* (Edwards 1921) after the genus *Mycetobia* was placed in the family *Rhypidae* or *Anisopodidae* (Edwards, 1916[2]).

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[2] Ann. Mag. Nat. Hist., (8), XVII, pp. 108–116.

Keilin on the basis of larval and pupal structure considered this subfamily a separate family, the *Ditomyidae.* The adult morphology does not point to such a separation (Edwards, 1921) and most workers have considered this group a subfamily of the *Mycetophilidae.*

There are two[3] nearctic genera separable as follows (modified after Edwards 1925):

Eyes reniform; R_4 hardly longer than the second portion of R_s; anepisternites setose; postnotum bare or setose................*Symmerus* Walker
Eyes rounded; R_4 much longer than the second portion of R_s; anepisternites bare; postnotum bare..............................*Ditomyia* Winnertz

DITOMYIA Winnertz

Ditomyia Winnertz, Stett. Ent. Zeit., VII, pp. 14–16, pl. 1, figs. 1–7, 1846. Johannsen, Gen. Insect., fasc. 93, pp. 10–11, pl. 3, fig. 8, 1909. Johannsen, Maine Agr. Exp. Sta. Bull., no. 172, p. 227, fig. 80, 1910.

Key to Nearctic Species of Ditomyia

Wings fasciate..*euzona* Loew
Wings hyaline ....*potomaca* new species

Ditomyia euzona Loew (Pl. XXIV, fig. 25.)

Ditomyia euzona Loew, Berl. Ent. Zeit., XIII, p. 130, 1869. Johannsen, Maine Agr. Exp. Sta. Bull., no. 172, p. 227, 1910. Johnson, Occas. Pap. Boston Soc. Nat. Hist., VII, p. 76, 1925.

J. M. Aldrich in his Catalogue of North American Diptera[4] lists "N.Y." following the reference to Loew with no reference to the type locality. This reference is either a misprint or refers to a male and female in the Loew collection labelled "N.Y. *Ditomyia euzona*" which I have examined and consider the male to be *Neoempheria macularis* and the female, labelled "*Empheria euzona*" to be *Mycomyia* sp. All these specimens have the same Loew Collection number.

NEW HAMPSHIRE: Franconia, White Mts., Grafton Co. [Johannsen, 1910; Johnson, 1925], 1 ♀, U.S.N.M. Fabyan, White Mts., Coos Co., August 23, (C. H. Townsend), 1 ♀, U.S.N.M.

DISTRICT OF COLUMBIA: no further data, (R. Osten Sacken), [Loew, 1869; Johannsen, 1910], 1 ♂, *type,* M.C.Z.

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[3] *Palaeoplatyura* removed to the *Ceroplatinae* by Edwards 1921, 1925.
[4] Smith, Misc. Coll., no. 1444, p. 138, 1905.

Ditomyia potomaca new species (Pl. XXIII, fig. 1.)

This species differs from the preceding species in having hyaline wings, a polished black color, and a very distinct male terminalium.

Male: Total length 5.5 mm. Head, thorax, and abdomen black. The yellow antennal setae with prominent black bases. Fore coxae yellow; mesocoxae and metacoxae deep brown. Wings hyaline with macrotrichia on the membrane except in the posterior half of the basal cell, cell Cu and in the Anal cell. Cross-vein r–m practically eliminated; R_4 arises over the base of the M fork. Male terminalia as figured.

Female: Similar to the male. Color a deeper and a more polished black; the fore coxae brown in the allotype, black in the paratype, the mesocoxae and the metacoxae black. The posterior half of the basal cell, cell Cu, and the Anal cell with macrotrichia apically as well as in the other cells.

Holotype.—♂; Great Falls of the Potomac, Fairfax County, Virginia; May 2, 1916, (W. A. McAtee); [Acad. Nat. Sci. Phila. no. 6628].

Allotype.—♀; Redding, Fairfield County, Connecticut; May 17, 1930, (A. L. Melander); [A. L. Melander Collection].

Paratype.—1 ♀; Glen Echo, Montgomery County, Maryland; April 27, (C. H. Curran); [U. S. National Museum].

SYMMERUS Walker

Symmerus Walker, List Dipt. Brit. Mus., I, p. 77, 1848. Johannsen, Gen. Insect., fasc. 93, p. 11–13, pl. 3, fig. 9, 1909. Johannsen, Maine Agr. Exp. Sta. Bull., no. 172, p. 228, fig. 81, 1910.

Plesiastina Winnertz, Stett. Ent. Zeit., XIII, p. 55, 1852.

Key to Nearctic species[5] *of Symmerus*

1. Postnotum bare .... *coqulus* Garrett
   Postnotum setose .... 2.
2. Thorax black; abdomen mainly black (males unknown); eastern species .... *tristis* Loew
   Thorax yellow or yellow with dark vittae .... 3.
3. Stalk of M subequal to M_{1+2}; male terminalia as in plate XXIII, figs. 4 and 4a .... *lautus* Loew
   Stalk of M shorter than M_{1+2}; male terminalia with subovoid styles (see reference to published figure below) .... *dilutus* Fisher

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[5] *S. annulatus* Mg. is said to occur in America; all specimens recorded of this species belong to one of the other species listed here with the possible exception of Cole and Lovett's specimen which I have not seen.

Symmerus tristis (Loew)

Plesiastina tristis Loew, Berl. Ent. Zeit., XIII, pp. 131–132, 1869.
Symmerus tristis Johannsen, Maine Agr. Exp. Sta. Bull., no. 172, p. 228, fig. 81, 1910. Johnson, Occas. Pap. Boston Soc. Nat. Hist., VII, p. 76, 1925. Shaw, Bull. Brook. Ent. Soc., XXXVI, p. 23, 1941.

Described and known only from females.

MAINE: Bar Harbor, Mt. Desert Island, Hancock Co., August 10, [Johnson, 1925], 1 ♀, B.S.N.H.

MASSACHUSETTS: Chester, Hampden Co., August 3, (C. W. Johnson), [Johnson, 1925], 1 ♀, B.S.N.H. No further data, (W. M. Wheeler), [Johannsen, 1910], 1 ♀, O.A.J.?

DISTRICT OF COLUMBIA: (R. Osten Sacken), [Loew, 1869; Johannsen, 1910], 1 ♀, *type*, M.C.Z.

NORTH CAROLINA: *Linville Falls, Burke Co., June 21 (3,200′), (C. P. Alexander), Shaw Coll.

INDIANA: Julietta, Marion Co., July 12, (C. W. Johnson), 1 ♀, M.C.Z.

Symmerus lautus (Loew) (Pl. XXIII, figs. 4 and 4a.)

Plesiastina lauta Loew, Berl. Ent. Zeit, XIII, p. 132, 1869.
Symmerus lauta Johannsen, Maine Agr. Exp. Sta. Bull., no. 172, p. 231, 1910.
Symmerus annulata Johnson in part[6] (nec Meigen), Occas. Pap. Boston Soc. Nat. Hist., VII, p. 76, 1925.
Symmerus lautus Leonard, Cornell Univ. Agr. Exp. Sta. Mem., no. 101, p. 740, 1928.

The figures are from a specimen in the Cornell University Collection and agree with the terminalium of the type at Cambridge.

None of the specimens recorded by Johnson as this species do I consider to belong here; I consider them to be *S. coqulus* Garrett.

VERMONT: St. Johnsbury, Caledonia Co., June 28, (C. W. Johnson), [Johnson, 1925 as *S. annulata* (Meigen)], 1 ♂, B.S.N.H. Dummerston, Windham Co., July 14, (C. W. Johnson), [Johnson, 1925 as *S. annulata* (Meigen)], 1 ♂, B.S.N.H.

NEW YORK: No further data, [Loew, 1896; Johannsen, 1910], 1 ♂, *type*, M.C.Z. Ithaca, Thompkins Co., August 24, (O. A. Johannsen), [Johannsen, 1910; Leonard, 1928], 1 defective specimen, C.U. Niagara Falls, Niagara Co., June 22, 1 ♂, U.S.N.M. North Evans, Erie Co., July, (M. C. Van Duzee), [Leonard, 1928], C.U. Little Valley, Cattaraugus Co., June, (M. C. Van Duzee), [Leonard, 1928], C.U.

MARYLAND: Plummer's Island, Montgomery Co., June 23, (W. A. McAtee), 1 defective specimen, U.S.N.M. Plummer's Island, Montgomery Co., June 30, (R. C. Shannon), 1 ♀, U.S.N.M.

INDIANA: Turkey Run, Parke Co., August 20, (J. M. Aldrich), 1 ♂, U.S.N.M.

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[6] "Vt. 18, 22" only; the remainder I consider to be *S. coqulus* Gtt.

Symmerus dilutus Fisher

Symmerus diluta Fisher, Trans. Am. Ent. Soc., LXIV, pp. 196–197, pl. 9, fig. 1, 1938.

No figure is given of the male terminalium as it has been figured in the above publication.

WEST VIRGINIA: Fairmont, Marion Co., June 22, (E. T. Cresson, Jr.), [E. G. Fisher, 1938], 1♂, *type,* A.N.S.P.

Symmerus annulatus (Meigen)

Mycetobia annulata Meigen, Syst. Beschr., VI, p. 294, 1830.

Symmerus annulatus ? Cole and Lovett, Proc. Calif. Acad. Sci., (4), XI, p. 217, 1921.

Symmerus annulata Tarwid, Ann. Mus. Zool. Polonici, IX, pp. 375–379, fig. 1933. Seguy, Fauna de France, Dipt. Nematoceres, XXXVI, pp. 20–21, figs. 60, 61, 1940.

Seguy says that this species has a setose postnotum; nearctic species that have been called *S. annulatus* (Smith, 1910; Johannsen, 1910; Johnson, 1925) have a bare postnotum and have been described as *S. coqulus.* The European forms have been figured by Seguy and Tarwid.

I have not seen those specimens assigned here by Cole and Lovett with a question but I suspect that they also are *S. coqulus.*

? OREGON: *Corvallis, Benton Co., Sept. 10, (F. R. Cole), [Cole and Lovett, 1921 determined with a ?], Oregon Agricultural College Collection?

Symmerus coqulus Garrett (Pl. XXIII, fig. 2.)

Plesiastina annulata Smith (nec Meigen), Ann. Report N. J. State Mus. for 1909, p. 722, 1910.

Symmerus annulata Johannsen in part (nec Meigen), Maine Agr. Exp. Sta. Bull., no. 172, p. 231 (records but not description), 1910. Johnson in part (nec Meigen), Occas. Pap. Boston Soc. Nat. Hist., VII, p. 76, 1925.

Symmerus lauta Johnson (nec Loew), Occas. Pap. Boston Soc. Nat. Hist., VII, p. 76, 1925.

Symmerus coqula Garrett, Sixty-one New Diptera, Cranbrook, B. C., p. 12, 1935.

This species runs in Johannsen's key to the couplet separating *S. lauta* and *S. annulata.* It differs from other species of the genus in having the postnotum bare. Garrett's description is of a female. He has been kind enough to lend me a male which he considers to be the same species as his female holotype. I describe below a male that is conspecific with Garrett's male; this male is from Idaho.

Total length 6 mm. Compound eyes distinctly reniform, almost meeting above the antennae separated by about once to twice the width of a lateral ocellus; ocelli three, arranged in a straight line, the median one slightly smaller. Head black, face yellow. Antennae seventeen jointed, yellow at the base becoming brown distally, the minute last segment yellow, papilliform.

Mesonotum yellow with three wide brown vittae, the median one sometimes lighter in color and with a yellow line along its median line. Scutellum, postnotum and pleura yellow. Mesonotum uniformly setose; anepisternites with a group of setae at the level of the anterior spiracle; sternopleurites, pteropleurites, pleurotergites and hypopleurites bare; scutellum setose, the marginal row hardly distinguishable from those of the disc; postnotum bare. Wings hyaline, appearing clouded due to the macrotrichia on the membrane; the macrotrichia evenly distributed over the entire wing membrane and veins. C ends at R_5; Sc ends free about the length of the humeral cross-vein beyond the latter; tip of R_4 parallel to R_1 apically; r–m present, distinct but short, about one third (one half in eastern forms) the length of m–cu; base of M fork clearly before the level of R_4; M faint; r–m, m–cu, and the base of Cu_1 in the same straight line; 1st A distinct; 2nd A faint but reaching the wing margin. Halteres yellow. Legs yellow. The middle and hind tibiae and the tarsi ventrally with scattered dark setae among the setulae; those of the fore tibiae and the tarsi not so prominent. Spur formula 1–2–2. All femora ciliate beneath.

Abdomen dark brown shining; bases and apices of the tergites yellow; basal sternites yellow; apical sternites dark brown with yellow lateral and apical margins. Terminalium large, the anal lamellae long, narrow, and yellow; styles deep black; zygosternum brown. The styles are very prominent even in an untreated terminalium.

Maine: Capen's, Deer Island, Moosehead Lake, Somerset Co., July 15, (C. W. Johnson), [Johnson, 1925 as *S. lauta* (Loew)], 1 ♀, B.S.N.H. Sugar Island, Moosehead Lake, Somerset Co., July 17, (C. W. Johnson), [Johnson, 1925 as *S. annulata* (Meigen)], 1 ♂, B.S.N.H. Eastport, Washington Co., July 16, [Johnson, 1925 as *S. lauta* (Loew)], 2 ♂, B.S.N.H.

Vermont: Mt. Ascutney (2,000′), Windsor Co., July 11, [Johnson, 1925 as *S. annulata* (Meigen)], 1 ♂, B.S.N.H.

New Hampshire: Mt. Washington, (2,599′), Coos Co., July 24–28, [Johnson, 1925 as *S. lauta* and as *S. annulata;* Johannsen, 1910 as *S. annulata*], 5 ♂, M.C.Z. and B.S.N.H. White Mts., Coos Co., (H. K. Morrison), 1 ♂, U.S.N.M. Dolly Coop, White Mt. Nat. For., Coos Co., July 13, (A. L. Melander), 2 ♂, A.L.M. and A.N.S.P. Franconia Notch, White Mt. Nat. For., Grafton Co., July 9, (A. L. Melander), 2 ♂, A.L.M. and A.N.S.P.

Massachusetts: Chester, Hampden Co., July 6 and August, (C. W. Johnson), [Johnson, 1925 as *S. annulata*], 2 ♂, M.C.Z. and B.S.N.H. New Lenox, Berkshire Co., July 24, [Johnson, 1925 as *S. annulata*] 1 ♂, B.S.N.H.

New Jersey: Riverton, Burlington Co., June 19, (C. W. Johnson), [Smith, 1910 as *Plesiastina annulata;* Johannsen, 1910 as *S. annulata*], 1 ♂, M.C.Z.

ALASKA: Seward, July 26, (J. M. Aldrich), 1 ♂, U.S.N.M.

ALBERTA: Waubamun, July 25, (E. H. Strickland), 1 ♂, Univ. of Alberta.

BRITISH COLUMBIA: Cranbrook, June, (C. B. D. Garrett), [Garrett, 1925], *1 ♀, *type*, C.B.D.G. St. Mary's Lake, Kimberley, August 29, (C. B. D. Garrett), 1 ♂, C.B.D.G. metatype.

IDAHO: Priest Lake, Bonner Co., August 1, (A. L. Melander), 1 ♂, A.L.M.

WASHINGTON: Mt. Constitution, Orcas Island, San Juan Co., July 23, (A. L. Melander), 1 ♂, A.L.M. Poulbo, Kitsap Co., August 17, (A. L. Melander), 1 ♀, A.L.M. Lilliwaup, Mason Co., July 28, (A. L. Melander), 1 ♂, A.N.S.P.

OREGON: Mt. Hood, Clackmas Co., July 30, (3,000′), (A. L. Melander), 1 ♂, A.L.M. Eagle Creek, Clackmas Co., June 16, (A. L. Melander), 1 ♂, A.N.S.P.

Subfamily DIADOCIDIINAE

Diadocidiinae Winnertz, Verh. Zool.-bot. Ges. Wien., XIII, p. 656, 1863. Johannsen, Gen. Insect. fasc. 93, pp. 12–13, pl. 3, fig. 10, 1909. Johannsen, Maine Agr. Exp. Sta. Bull., no. 172, p. 231, 1910.

There is but one nearctic genus, *Diadocidia* Ruthe.

DIADOCIDIA Ruthe

Diadocidia Ruthe, Isis, II, p. 1210, 1831. Johannsen, Gen. Insect. fasc. 93, p. 12, pl. 3, fig. 10, 1909. Johannsen, Maine Agr. Exp. Sta., Bull. no. 172, pp. 231–232, fig. 91, 1910.

Macroneura Macquart, Suites à Buffon, I, p. 146, 1834.

? *Aclada* Loew, Berstein Fauna, p. 35, 1850. (No species.)

Key to Nearctic Species

Apex of R_1 about opposite the fork of M and proximad of the level of the tip of Cu_1; female fore tarsi swollen below; style of male terminalium with a single stout apical spine........................*ferruginosa* (Meigen)

Apex of R_1 distad of the fork of M and usually about opposite the level of the tip of Cu_1; female fore tarsi simple; style of the male terminalium with two stout apical spines and two strong subapical setae on their mesal aspects..*borealis* Coq.

Diadocidia ferruginosa (Meigen) (Pl. XXIII, figs. 5 and 6.)

Mycetobia ferruginosa Meigen, Syst. Beschr., VI, p. 294, 1830.

Diadocidia ferruginosa Coquillett, Proc. Wash. Acad. Sci., II, p. 390, 1900. Johannsen, Maine Agr. Exp. Sta., Bull. no. 172, p. 232, fig. 91, 1910. Edwards, Trans. Ent. Soc. London, 1924, p. 515, fig. 185, 1925. Johnson, Occas. Pap. Boston Soc. Nat. Hist., VII, p. 77, 1925. Leonard, Cornell Univ. Agr. Exp. Sta., Mem. no. 101, p. 740, 1928. Shaw and Townes, Bull. Brook. Ent. Soc., XXXI, p. 204, 1936. Shaw, Bull. Brook. Ent. Soc., XXXVI, p. 24, 1941.

QUEBEC: Laurentian Mts., June, (C. P. Alexander), det. F. R. Shaw, C.U.

NOVA SCOTIA: Big Intervale, Cape Breton Island, August 30, (E. G. Fisher), 1 ♂, A.N.S.P.

MAINE: Great Pond, Mt. Desert Island, June 27, 1 ♀, B.S.N.H.

NEW HAMPSHIRE: White Mts., Coos and Grafton Cos., (H. Morrison), [Coquillett, 1900; Johannsen, 1910; Johnson, 1925], 2 ♀, U.S.N.M.

MASSACHUSETTS: Auburndale, Middlesex Co., *July 10, *July 16, August 16, (C. W. Johnson), [Johannsen, 1910; Johnson, 1925], 1 ♂, B.S.N.H. Chester, Hampden Co., August 7, [Johnson, 1925], 1 ♂, O. A. Johannsen det., B.S.N.H. Petersham, Worchester Co., June 9, (A. L. Melander), 3 ♂, 1 ♀, A.L.M.

CONNECTICUT: Sandy Hook, Fairfield Co., June 5, (A. L. Melander), 1 ♀, A.L.M.

NEW YORK: Wells, Hamilton Co., July, (D. B. Young), [Leonard, 1928], C.U. Erie Co., May, August, (M. C. Van Duzee), [Leonard, 1928], C.U. McLean, Thompkins Co., August, C.U.? Gloversville, Fulton Co., C.U. Ithaca, Thompkins Co., June 27, (A. L. Melander), 1 ♂, A.L.N. and August 10, (C. W. Johnson), [Johannsen, 1910 and Leonard, 1928], C.U.

PENNSYLVANIA: Hazleton, Luzerne Co., May 25, June 23, July 11, September 18, (W. C. Dietz), 4 ♂, A.N.S.P. Dubois, Clearfield Co., September 3, (A. L. Melander), 1 ♂, A.L.M.

NORTH CAROLINA: Great Smoky Natl. Pk., June 6, (5,500′), (C. P. Alexander), Shaw Coll.

SOUTH CAROLINA: *Old Indian Mt., Greenville Co., July 13, (1,400′), (H. K. Townes Jr.), [Shaw and Townes Jr., 1936], F. R. Shaw det.

WASHINGTON: Skyline Trail, Mt. Baker, Whatcom Co., August 10 (A. L. Melander), 1 ♂, A.N.S.P. Nooksack River, Mt. Baker, Whatcom Co., August 10, (A. L. Melander), 1 ♂, A.L.M. Sequim Bay, Callam Co., September 3, (A. L. Melander), 1 ♂, A.L.M. Puget, Thurston Co., July 4, (A. L. Melander), 1 ♂, A.N.S.P. Fairflax Trail, Mt. Ranier Nat. Park, August 9, (A. L. Melander), 1 ♂, A.N.S.P. Wahkeena Falls, Multnomah Co., June 21, (A. L. Melander), 1 ♂, A.L.M.

CALIFORNIA: Orick, Humboldt Co., June 21, (A. L. Melander), 1 ♀, A.L.M.

These specimens show that the presence or absence of Sc_2 is variable within the species.

Diadocidia borealis Coquillett (Pl. XXIII, fig. 3.)

Diadocidia borealis Coquillett, Proc. Wash. Acad. Sci., II, p. 390, 1900. Johannsen, Maine Agr. Exp. Sta., Bull. no. 172, p. 233, 1910. Cole and Lovett, Proc. Calif. Acad. Sci., (4), XI, p. 217, 1921. Johnson, Occas. Pap. Boston Soc. Nat. Hist., VII, p. 77, 1925. Shaw and Townes, Bull. Brook. Ent. Soc., XXXI, p. 206, 1936.

The figure is of one of the typical males from the west coast.

New Hampshire: Bretton Woods, Coos Co., June 24, [Johnson, 1925], 1 ♀, O. A. Johannsen determined this specimen with a question, B.S.N.H.

North Carolina: *Big Pisgah Mt., (1,200–1,400′), Haywood Co., July 16–19, (H. K. Townes Jr.), [Shaw and Townes Jr., 1936], F. R. Shaw det.

South Carolina: *Old Indian Mt., Greenville Co., July, (H. K. Townes Jr.), [Shaw and Townes Jr., 1936], F. R. Shaw det., Townes or Shaw Coll.?

British Columbia: Lowe Inlet, [Coquillett, 1900; Johannsen, 1910], 1 ♂, *type*, U.S.N.M.

Washington: Olga, San Juan Co., May 17, (A. L. Melander), 1 ♂, A.L.M. Vashon, King Co., May 28, (A. L. Melander), 1 ♀, A.L.M. Longmire, Mt. Ranier Nat. Park, June 27, (A. L. Melander), 1 ♀, A.N.S P. South Bend, Pacific Co., May 23, (A. L. Melander), 2 ♂, A.L.M. and A.N.S.P.

Oregon: *Forest Grove, Washington Co., February 10, March 14, May 2, (F. R. Cole), [Cole and Lovett, 1921], F. R. Cole det., Oregon Agricultural College Collection?

California: Berkeley Hills, Alameda Co., April 14, (R. M. Fuchs), 1 ♀, A.N.S.P. Sonoma Co., March 1, (W. C. Dietz?), 1 ♀, A.N.S.P. Eureka, Humbolt Co., (H. S. Barber), 1 ♀, U.S.N.M.

In one female taken by Cole the tip of R_1 is distinctly proximad of the tip of Cu_1. I have not seen it and do not know whether the fore tarsi are swollen as in the typical specimens.

Subfamily CEROPLATINAE

Ceroplatinae, Winnertz Verh. Zool.-bot. Ges. Wien, XIII, p. 684, 1863. Johannsen, Gen. Insect., fasc. 93 p. 13, 1909. Johannsen, Maine Agr. Exp. Sta., Bull. no. 172, p. 233, 1910. Edwards, Trans. Ent. Soc. London, 1924, p. 522, 1925. Edwards, Proc. Linn. Soc. N. S. Wales, LIV, pp. 162–175, 1929.

The known Ceroplatinae of Nearctica may be divided into six genera (five if we follow Tarwid or eight if we follow Edwards[7]).

Key to Nearctic Genera[8]

1. Antennae stout and flattened, often conspicuously so; palpi short apparently consisting of a single porrect segment...........*Ceroplatus* Bosc
   Antennae not conspicuously flattened; palpi normal..................2.
2. Media with a distinct fold-like basal section..........................3.
   Media without a distinct fold-like basal section.......................5.
3. Cross-vein r–m short, but present...............*Palaeoplatyura* Meunier
   Cross-vein r–m absent; R_s and M fused for a distance...............4.

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[7] Tarwid, C. R. Soc. Sci. Varsovie, (4), XXIX, p. 39, 1936. Edwards, Rev. Ent., Rio de J., XI, p. 446, 1940; Edwards, Ent. Month. Mag., LXXVII, p. 23, 1941.

[8] Partly after Edwards, 1925.

4. No ocelli; R_4 ends in C.......................... *Hesperodes* Coquillett
Three ocelli; R_4 ends in R_1....... [*Apemon* Johannsen] *Platyura* Meigen
5. Labella greatly elongate and fleshy.................... *Asindulum* Latr.
Mouthparts not elongate.......................... *Platyura* of authors

CEROPLATUS Bosc

Keroplatus Bosc, Acta Soc. Hist. Nat. Paris, I, p. 42, 1792.

Ceroplatus Johannsen, Gen. Insect., fasc. 93, pp. 18–19, 1909. Johannsen, Maine Agr. Exp. Sta., Bull. no. 172, pp. 234–240, 1910. Edwards, Proc. Linn. Soc. N. S. Wales, LIV, pp. 173–175, 1929. Edwards, Rev. Ent., Rio de J., XI, p. 446, 1940.

Cerotelion Rondani, Dipt. Ital. Prodromus, I, p. 191, 1856. Johannsen, Gen. Insect., fasc. 93, p. 19, 1909. Johannsen, Maine Agr. Exp. Sta., Bull. 172, p. 234–240, 1910.

Heteropterna Skuse, Proc. Linn. Soc. N. S. Wales, III, p. 166, 1888. Johannsen, Gen. Insect., fasc. 93, p. 17, 1909. Edwards, Rev. d. Ent., Rio de J., XI, p. 446, 1940.

Edwards (1929) revised the genus *Ceroplatus* Bosc dividing it into six subgenera. One of these subgenera is not known from this hemisphere. The other five may be characterized as follows (after Edwards 1929):

Ceroplatus: Nearctic and Neotropical.[9] R_4 ends in R_1; two or three ocelli;

Cerotelion: Nearctic. R_4 ends in C; three ocelli; pleurotergites bare; tibial setulae irregularly arranged; face broad.

Euceroplatus: Nearctic and Neotropical. R_4 ends in C; three ocelli; pleurotergites bare; tibial setulae regularly arranged; face narrow.

Heteropterna:[10] Nearctic and Neotropical. R_4 ends in C; three ocelli;

Placoceratias: Neotropical. R_4 ends in C; two ocelli; pleurotergites hairy; tibial setulae regularly arranged.

The American species belong to the following subgenera:

Subgenus CEROPLATUS

Ceroplatus (*Ceroplatus*) *carbonarius* Bosc, *Ceroplatus* (*Ceroplatus*) *clausus* Coquillett, *Ceroplatus* (*Ceroplatus*) *clausus terminalis* Coquillett, *Ceroplatus* (*Ceroplatus*) *militaris* Johannsen, *Ceroplatus* (*Ceroplatus*) *fiebrigi* Edwards, *Ceroplatus* (*Ceroplatus*) *minimax* Edwards, *Ceroplatus* (*Ceroplatus*) *striatus* new species.

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[9] Known distribution given only for the Nearctic and Neotropical Regions. pleurotergites hairy; tibial setulae regularly arranged.

[10] Edwards, 1940, restores *Heteropterna* to generic rank on the structure of the postnotum. The postnotum has a membranous dorsal triangular area. Since this membranous area occurs (less developed and less well defined) in certain species (*Ceroplatus clausus* and *Ceroplatus militaris*) that cannot be included in this genus I have preferred to retain *Heteropterna* as a subgenus. pleurotergites bare; tibial setulae irregularly arranged; face narrow.

Subgenus **CEROTELION**

Ceroplatus (*Cerotelion*) *johannseni* Fisher, *Ceroplatus* (? *Cerotelion*) *apicalis* Adams.

Subgenus **EUCEROPLATUS**

Ceroplatus (*Euceroplatus*) *fasciolus* Coquillett, *Ceroplatus* (*Euceroplatus*) *fasciatus* (Garrett), *Ceroplatus* (*Euceroplatus*) *fasciatus fenestralis* Fisher, *Ceroplatus* (*Euceroplatus*) *bellulus* Williston.

Subgenus **HETEROPTERNA**

Ceroplatus (*Heteropterna*) *major* (Curran) nec Meunier, *Ceroplatus* (*Heteropterna*) *cressoni* new species, *Ceroplatus* (*Heteropterna*) *tetraleucus* (Edwards), *Ceroplatus* (*Heteropterna*) *trileucus* (Edwards).

Subgenus **PLACOCERATIAS**

Ceroplatus (*Placoceratias*) *bimaculipennis* (Enderlein), *Ceroplatus* (*Placoceratias*) *fuscithorax* (Enderlein), *Ceroplatus* (*Placoceratias*) *longimanus* (Williston).

Subgenus unknown

Ceroplatus (....?) *obscurus* Philippi, *Ceroplatus* (....?) *fernaldi* Shaw.

Key to Nearactic Species[11] *of Ceroplatus*

1. R_4 ends in R_1; pleurotergites hairy (*Ceroplatus*)......................2
   R_4 ends in C; pleurotergites bare..................................5
2. Tips of antennae white; large specimens 10–13 mm. in length *carbonarius* Bosc
   Antennae uniform in coloration; smaller specimens 3.7 mm.–10 mm. in length..3
3. Male terminalium with the style tips rounded; abdomen predominately yellow..4
   Male terminalium with the style tips pointed; abdomen predominately dark brown.................................*militaris* Johannsen
4. Eastern forms; delicate species for this genus; usually under 8.5 mm.; wings usually with a brown spot apically over vein R_4 and beyond *clausus* Coquillett
   Western forms, robust forms; usually over 8.5 mm.; the wing apex very deeply clouded especially anteriorly and behind Cu_2 *clausus terminalis* Coquillett
5. Tibial setulae irregularly arranged (*Cerotelion* and *Heteropterna*).....6
   Tibial setulae regularly arranged (*Euceroplatus*)....................8

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[11] For those specimens of *Ceroplatus bellulus* listed from Nearctica see *Ceroplatus johannseni*. I do not know Shaw's *C. fernaldi*, 1941, and have omitted it from this key.

6. Face very narrow; non-sclerotized triangular area on metanotum large and well defined (*Heteropterna*)................*cressoni* new species

Face of normal width; metanotum normal (*Cerotelion*)...............7

7. Sc ends in C beyond the level of R_s.................*johannseni* Fisher

Sc ends in C before the level of R_s, half-way between the humeral cross-vein and R_s....................................*apicalis* Adams

8. Wings with the tip only with a diffuse fascia anteriorly; delicate species for this genus..................................*fasciatus* Garrett[12]

Wings with the whole tip with a diffuse fascia; robust species..........9

9. Wings with tip more deeply colored in cells R_4 and R_5 and with a hyaline spot before the apex of cell R_5.............*fasciatus fenestralis* Fisher

Wings with tip diffusely but uniformly colored and with cell Cu_1 colored..*fasciolus* Coquillett

Ceroplatus (Ceroplatus) carbonarius Bosc

Ceroplatus carbonarius Bosc, Nouv. Dict. Nat. Hist. (edit. 1), IV, p. 543; (edit. 2), V, p. 585, tab. B, 21, figs. 4, 4a, 1802–1804. Johannsen, Gen. Insect., fasc. 93, p. 18, 1909. Johannsen, Maine Agr. Exp. Sta., Bull. no. 172, p. 236, 1910.

Platyura carbonarius Wiedemann, Aussereup. Zweigl. Ins., I, p. 61, 1828.

PENNSYLVANIA: No further data, [Loew, manuscript as "*C. ater?* Bosc"], 1 defective specimen, M.C.Z.

"CAROLINA": *, [Bosc, 1802–1804], *type*.

INDIANA: Princeton, Gibson Co., June 17, (J. H. Davis), 1 ♂, U.S.N.M.

TENNESSEE: Clarksville, Mongomery Co., July 7, 1 ♂, U.S.N.M.

These last two specimens and the first specimen differ in color from the type description. They are brown rather than black but have the prominent white tips to the antennae.

The male terminalia resemble *Ceroplatus clausus* except the styles and the setulae on them are very robust.

A description of the Tennessee specimen follows:

Male: Total length 13 mm. Head with three ocelli on a black ocellar area; the face and occiput yellow, the palpi yellow, the terminal segment porrect. Antennal flagellum with fifteen segments, the basal segments black, the terminal five white. The distal antennal segment very minute.

Pronotum, propleura, and prosternum brownish yellow with black setae. The posterior division of the propleura with many black setae above. Setae present both before and behind the anterior spiracle. Mesonotum light brown with a brown V and faint lateral lines of brown, uniformly setose, the setae thicker laterally. Anepisternite yellow above, brown below, with a few inconspicuous setae. Sternopleurites yellow above, brown below and bare. Pleurotergites brown anteriorly, uniformly setose, projecting. Scutellum setose above in addition to the numerous marginal setae. Postnotum brown, yellow at the margins, bare.

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[12] I suspect that *C. fasciatus* Garrett and *C. fenestralis* Fisher are simply varieties of *C. fasciolus* Coquillett but until a male is found agreeing with *C. fasciolus* more closely I believe it is better to retain *C. fasciatus* as distinct from *C. fasciolus* and to treat *C. fenestralis* as a variety of *C. fasciatus*. The latter agree in terminalial structure.

Coxae yellow, the fore coxae brown mesally; the hind femora brown at their bases and at their mid-points. Tibial setulae regularly arranged, all rows alike.

Wings fasciate; a very prominent spot over the tip of R_1, over R_4 and extending posteriorly to M_{1+2}; tips of M_{1+2}, M_3, Cu_1 and Anal vein with brown clouds; Cu_2 with a cloud just before the apex.

Abdomen yellow, the lateral margins of the tergites brown. The bases of the first and second tergites and the posterior margin of the eighth tergite brown. The apical half of the first sternite and the margin of the eighth brown. Male terminalium yellow.

Ceroplatus (Ceroplatus) clausus Coquillett (Pl. XXIII, figs. 9, 10.)

Ceroplatus clausus Coquillett, Proc. U. S. Nat. Mus., XXIII, p. 594, 1901. Slosson, Ent. News, XIII, p. 7, 1902. Smith, Ann. Report N. J. State Mus. for 1909, p. 723, 1910. Johnson, Occas. Pap. Boston Soc. Nat. Hist., VII, p. 77, 1925.

Ceroplatus militaris Johnson in part (nec Johannsen), Occas. Pap. Boston Soc. Nat. Hist., VII, p. 77, 1925.

The type of *C. clausus* is a female. There are three ocelli. The face is moderately broad; R_4 ends in R_1; the tibial setulae are in very distinct rows; the pleurotergites are bare. There is a male from the same locality as the type in the U. S. National Museum; this specimen is probably one of the original co-types. The male terminalium does not differ from that of *C. terminalis*. The character Johannsen used to separate these species (length of M stalk compared to length of R and M fusion) is variable.

MAINE: Bar Harbor, Mt. Desert Island, Hancock Co., September 13, [Johnson, 1925], 2 ♀, B.S.N.H.

NEW HAMPSHIRE: Franconia, Grafton Co., (Mrs. A. T. Slosson), [Coquillett, 1901; Slosson, 1902], 1 ♀, *type*, U.S.N.M. Same data, 1 ♂, U.S.N.M.

MASSACHUSETTS: Lynn, Essex Co., February, (G. H. Parker), 1 ♂ det. C. W. Johnson as *C. militaris* Joh., B.S.N.H. Brookline, Norfolk Co., September 24, 1 ♂, det. C. W. Johnson as *C. militaris* Joh., B.S.N.H.

RHODE ISLAND: *Kington, Washington Co., August 21, [Johnson, 1925].

CONNECTICUT: Redding, Fairfield Co., July 20, September, (A. L. Melander), 1 ♀, 1 ♂, A.L.M. and A.N.S.P.

NEW YORK: Ithaca, Thompkins Co., (O. A. Johannsen), [Johannsen, 1910], C.U., June and August, (E. G. Fisher), A.N.S.P. South Wales, Erie Co., July, (M. C. Van Duzee), [Leonard, 1928], C.U.?

NEW JERSEY: No further data, (H. Loew), 1 ♂, M.C.Z. New Brunswick, Middlesex Co., (J. B. Smith), [Coquillett, 1901 as *C. clausus;* Smith, 1910 as *C. clausus*], 1 ♂, A.N.S.P.

PENNSYLVANIA: Philadelphia, Montgomery Co., July 6, 1 ♂, det. D. W. Coquillett, A.N.S.P.

MARYLAND: No further data, 1 ♂, M.C.Z. Seat Pleasant, Prince Georges Co., June 14, (J. M. Aldrich), 1 ♂, U.S.N.M.

SOUTH CAROLINA: *Greenville, Greenville Co., September 18, (950'), (H. K. Townes Jr.), [Shaw and Townes Jr., 1935], F. R. Shaw det., Shaw or Townes Coll.?

MICHIGAN: East Lansing, Ingham Co., September 8, (C. W. Sabrosky), 1 ♂, 1 ♀, Univ. Michigan Coll.

ILLINOIS: White Heath, Piatt Co., August 27, (J. C. Dirks), 1 ♂, A. Stone det., U.S.N.M.

IOWA: Muscatine Co., August 20–28, (B. Berger), 3 ♂, Iowa Insect Survey Collection at Iowa Wesleyan College and A.N.S.P. Henry Co., September 3, (B. Berger), 1 defective specimen, W. V. Balduff Collection. Des Moines Co., September 3, (B. Berger), 1 ♂, W. V. Balduff Collection.

LOUISIANA: Negreet, Savine Co., April 15, (W. Newell; Louisiana Crop Pest Comm.), 1 ♂, U.S.N.M.

TEXAS: Dallas, Dallas Co., August 31, (F. C. Pratt), 1 ♂, U.S.N.M. Dallas, Dallas Co., September 20, (W. E. Hinds), 1 defective specimen, U.S.N.M. Victoria, Victoria Co., (J. D. Mitchell), 1 ♂, 1 ♀, U.S.N.M. Houston, Harris Co., (A. C. Chandler), 1 ♀, U.S.N.M.

There is a great deal of variation between the Iowa specimens. Those form Henry and Des Moines Cos. have black spots over the tip of vein R_1 and R_4. The two Maines specimens show a variation in size. The male terminalia are all apparently identical.

The total length varies from five to eight millimeters. The abdomen varies from almost entirely yellow to almost entirely brown; the color of the head is brownish or yellow with black around the ocelli. This is apparently a very variable species.

Ceroplatus (Ceroplatus) clausus terminalis Coquillett

Ceroplatus terminalis Coquillett, Jour. N. Y. Ent. Soc., XIII, p. 69, 1905.

Ceroplatus clausus var. *terminalis* Fisher, Cornell Univ. Abstracts of theses —1937. Ithaca, N. Y., p. 221, 1938.

The terminalia of *C. clausus* and of *C. terminalis* in the Johannsen collection are identical. There are western forms in the Cornell University Collection showing the coalesced portion of the media longer than the petiole with the abdominal markings as described for *C. clausus.*

The holotype of *C. terminalis* differs from that of *clausus* as indicated in the key above.

BRITISH COLUMBIA: Kaslo, July 16, (R. P. Currie), [Coquillett, 1905 as *C. terminalis;* Johannsen, 1910 as *C. terminalis*], 1 ♂, *type* of *terminalis,* U.S.N.M.

TEXAS: Victoria, Victoria Co., (Bridwell), ?6 ♀, U.S.N.M.

Ceroplatus (Ceroplatus) militaris Johannsen (Pl. XXIII, figs. 7, 8, 12.)

Ceroplatus militaris Johannsen, Maine Agr. Exp. Sta. Bull., no. 172, p. 237–238, 1910. Johnson in part, Occas. Pap. Boston Soc. Nat. Hist., VII, p. 77, 1925. Leonard, Cornell Univ. Agr. Exp. Sta. Mem., no. 101, p. 741, 1928. Jacques and Berger, Iowa Acad. Sci., XLVI, p. 421, fig. 1, p. 419, 1939.

MAINE: Bar Harbor, Mt. Desert Island, Hancock Co., September 13, [Johnson, 1925], 1 ♂, B.S.N.H.

NEW HAMPSHIRE: Intervale, Carroll Co., August 28, (G. M. Allen), [Johannsen, 1910 and Johnson, 1925], 3 ♂, O. A. Johannsen det., *paratypes,* B.S.N.H. *Hampton, Rockingham Co., June 30, (I. H. Shaw), [Johnson, 1925].

CONNECTICUT: Redding, Fairfield Co., Aug. 19, Sept., (A. L. Melander), 2 ♂, A.L.M. and A.N.S.P.

NEW YORK: Ithaca, Thompkins Co., July, [Johannsen, 1910; Leonard, 1928]. McLean Wildflower Preserve, McLean, Thompkins Co., August, (E. G. Fisher), A.N.S.P.

NEW JERSEY: New Brunswick, Middlesex Co., 1 ♂, U.S.N.M.

PENNSYLVANIA: Hazleton, Luzerne Co., September 3, (W. C. Dietz), 1 ♂, A.N.S.P. Philadelphia, August 12, (C. W. Johnson), 1 ♂, *type,* M.C.Z. Philadelphia, August 1, (C. W. Johnson), [Johannsen, 1910], 1 ♀, *paratype,* M.C.Z. Frankford, Philadelphia, September 13, (J. R. Malloch), 2 ♂, A.N.S.P.

MARYLAND: Plummer's Island, Montgomery Co., August 4–13, (H. S. Barber), "larvae spinning slimy webs underside of *Polyporus,*" 1 ♂, 2 ♀, U.S.N.M.

DISTRICT OF COLUMBIA: Washington, 1 ♂, U.S.N.M.

FLORIDA: Paradise Key, Dade Co.?, February 23, (C. W. Johnson), 1 ♂, det. as *C. carbonarius* evidently by C. W. Johnson, M.C.Z.

TENNESSEE: Knoxville, Knox Co., July 3, (J. R. Malloch), 1 ♂, U.S.N.M.

MICHIGAN: Midland Co., June 28, (R. R. Dreisbach), 1 ♂, R. R. Dreisbach Collection.

IOWA: Muscatine Co., August 11, (B. Berger), [Jacques and Berger, 1938], 1 ♂, Iowa Insect Survey Collection at Iowa Wesleyan College.

WASHINGTON: Ashford, Pierce Co., (H. G. Dyar and A. N. Caudell), 1 ♀, U.S.N.M.

Ceroplatus (....?) fernaldi Shaw

Ceroplatus fernaldi Shaw, Psyche, XLVIII, pp. 20–21, 1941.

MASSACHUSETTS: Amherst, Hampshire Co., 1 ♂, *type,* Shaw Coll.

I do not know this species.

Ceroplatus (Cerotelion) johannseni Fisher (Pl. XXIII, fig. 11.)

Cerotelion bellulus Johannsen in part (nec Williston), Maine Agr. Exp. Sta. Bull., no. 172, p. 240, 1910. Johnson (nec Williston), Occas. Pap. Boston Soc. Nat. Hist., VII, p. 77, 1925. Brimley (nec Williston), The Insects of N. Carolina, N. C. Dept. Agr., Div. Ent., p. 326, 1938.

Ceroplatus (*Cerotelion*) *johannseni* Fisher, Ent. News, LI, pp. 243–245, 1940. Shaw, Bull. Brook. Ent. Soc., XXXVI, p. 24, 1941.

NEW HAMPSHIRE: Franconia, Grafton Co., (Mrs. A. T. Slossom), 2 ♂, U.S.N.M.

MASSACHUSETTS: Brookline, Norfolk Co., July 21, [Johnson, 1925 as *Cerotelion bellulus*], 1 ♂, B.S.N.H.

RHODE ISLAND: Buttonwood, Kent Co., June 22, [Johnson, 1925 (July 22) as *Cerotelion bellulus*], 1 ♀, B.S.N.H.

CONNECTICUT: Redding, Fairfield Co., June 10–16, (A. L. Melander), 2 ♂, 1 ♀, *paratypes*, A.N.S.P. and A.L.M.

NEW JERSEY: Delaware Water Gap, Warren Co., July 12, (C. W. Johnson), ?1 ♀, det. C. W. Johnson as *Platyura melasoma*, M.C.Z.

PENNSYLVANIA: Pottstown, Montgomery Co., (C. W. Johnson), [Johannsen, 1910 as *Cerotelion bellulus*], 1 ♂, O.A.J.

MARYLAND: Plummer's Island, Montgomery Co., May 22–August 17, (Swartz, Barber and Crawford; "taken in spider webs"), 11 ♂, U.S.N.M. Glen Echo, Montgomery Co., July 20, (R. M. Fouts), 1 ♂, U.S.N.M. Glen Echo, Montgomery Co., July 2, (W. L. McAtee), 1 ♂, U.S.N.M.

NORTH CAROLINA: Raleigh, Wake Co., April 25–27, (B. B. Fulton), [Fisher, 1940], 1 ♂, *type*, A.N.S.P., 2 ♀, *paratypes*, A.N.S.P. Raleigh, Wake Co., May, (C. S. Brimley), [Brimley, 1938 as *C. bellulus*], 1 ♂, North Carolina State College Collection. Southport, Brunswick Co., April 11, (B. B. Fulton), 1 ♀, allotype, A.N.S.P. April 24, (B.B. Fulton), [Fisher, 1940], 1 ♀, *paratype*, B. B. Fulton Collection. Black Mts., Buncombe and Yancey Cos., (W. G. Dietz), [Fisher, 1940], 1 ♂, A.N.S.P. *Great Smoky National Park, (3,000′), (C. P. Alexander), Shaw Coll.

GEORGIA: Fort Benning, Chattahoochee Co., October 11, (I. R. Slaughter), 1 ♂, U.S.N.M.

IOWA: Muscatine Co., August 28, (B. Berger), [Fisher, 1940], 2 ♂, *paratypes*, A.N.S.P. and Iowa Insect Survey Collection at Iowa Wesleyan College.

There is considerable difference in size and in color among these specimens. All agree in the structure of the male terminalium.

Ceroplatus (Cerotelion?) apicalis Adams

Ceroplatus apicalis Adams, Kansas Univ. Sci. Bull., II, p. 22, 1903.

Cerotelion apicalis Johannsen, Gen. Insect., fasc. 93, p. 19, 1909. Johannsen, Maine Agr. Exp. Sta. Bull., no. 172, p. 239, 1910.

This species, described from a male specimen, was placed by Johannsen in *Cerotelion*. I do not know this species so retain it in the subgenus *Cerotelion* although it may belong to any of the other subgenera in which R_4 ends in C as these were unrecognized at the time of Johannsen's monograph.

KANSAS: *Douglas Co., (E. S. Tucker), [Adams, 1903], 1 ♂, *type*, University of Kansas Collection.

Ceroplatus (Euceroplatus) fasciolus Coquillett

Ceroplatus fasciola Coquillett, Ent. News, v, p. 126, 1894.
Platyura fasciola Coquillett, Canad. Ent., XXVII, p. 200, 1895. Johannsen, Maine Agr. Exp. Sta. Bull., no. 172, p. 251, 1910.

I have seen the type and consider this species to belong to this genus as the antennae are flattened and the palpi are porrect and minute. No males of this species are known (see footnote number 12).

WASHINGTON: (O. B. Johnson), [Coquillett, 1894], 1 ♀, *type*, U.S.N.M.
ARKANSAS: "Mapewate,"* September 27, (C. W. Johnson), 1 ♀, M.C.Z.

Ceroplatus (Euceroplatus) fasciatus (Garrett)

Ceratelion fasciata Garrett, Sixty-one New Diptera, Cranbrook, B. C., p. 12, 1925. [Ceratelion lapsus calami for Cerotelion.]

I am greatly indebted to Mr. C. B. D. Garrett for a metatype male of *C. fasciatus* with which I compared the holotype of *C. fenestralis*. My specimen is very different in coloration and in wing markings but the male terminalia do not appear to differ; I therefore treat my specimen as a subspecies of Garrett's (see footnote no. 12).

BRITISH COLUMBIA: Cranbrook, (C. B. D. Garrett), [Garrett, 1925], *1 ♀, *type*, C.B.D.G. Cranbrook, (C. B. D. Garrett), 1 ♂, metatype, C.B.D.G. Terrace, (Mrs. Hippley), 1 ♂, det. C. W. Johnson as *Cerotelion bellulus* Will., M.C.Z.

WASHINGTON: Ilwaco, Pacific Co., May 25, August 27, (A. L. Melander), 2 ♂, A.L.M. and A.N.S.P.

CALIFORNIA: Calistoga, Napa Co., October 19, (P. C. Ting), 1 ♂, U.S.N.M.

Ceroplatus (Euceroplatus) fasciatus fenestralis Fisher

Ceroplatus (Euceroplatus) fenestralis Fisher, Trans. Amer. Ent. Soc., LXIV, p. 197, pl. 9, fig. 8, 1938.

MICHIGAN: Isle Royale, Keweenaw Co., August 3–7, (C. W. Sabrosky), [Fisher, 1938], 1 ♂, *type* of *fenestralis*, A.N.S.P.

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* I am unable to locate this locality and wonder if the handwritten label should read Maplevale, Pulaski Co.

Ceroplatus (Euceroplatus) bellulus Williston

Ceroplatus bellulus Williston, Biol. Centr. Amer. Dipt., I, p. 219, pl. 4, fig. 3, 1900.

Cerotelion bellulus Johannsen, Gen. Insect., fasc. 93, p. 19, 1909.

Ceroplatus (*Euceroplatus*) *bellulus* Edwards, Proc. Linn. Soc. N. S. Wales, LIV, p. 174, 1925.

Edwards (1925 and in litt.) says that the type specimen in the British Museum from Mexico belongs to the subgenus *Euceroplatus*. Nearctic specimens that have been referred here (Johannsen, 1910; Johnson, 1925; Brimley, 1938) belong to the subgenus *Cerotelion*. The author has described the nearctic species under the name *Ceroplatus* (*Cerotelion*) *johannseni*.

Ceroplatus (Heteropterna) cressoni new species (Pl. XXIV, fig. 14.)

This is the first nearctic species to be referred to this subgenus. This species differs from *Ceroplatus* (*Heteropterna*) *major* (Curran) nec Meunier in having three rather than one apical segment yellow and in having the coxae black not yellow. Curran's species, described from a female, is from Jamaica; this species is from Pennsylvania. It apparently is close to the Brazilian species *Heteropterna tetraleuca* Edwards and *Heteropterna trileuca* Edwards resembling the latter more closely in coloration.

Male: Total length 7 mm. Head black above, face very narrow, yellow. Palpi minute, porrect. Three ocelli, the middle ocellus much smaller than the lateral ocelli. The antennal scape and the eleven proximal joints of the flagellum black, the distal portion of the flagellum yellow.

Prothorax deep brown with black setae. Prosternum setose. Mesonotum yellow with a median black line, a black V-shaped line whose anteriorly directed arms meet the lateral stripes at the humeral angles. Anepisternites bare, black above, deep brown below. Sternopleurites deep brown with a yellow spot. Pteropleurites yellow above, bare. Scutellum yellow. Postnotum yellow, its dorsum with a very distinct triangular membranous area (see footnote 10).

Coxae black. Tibiae with their tips deep brown especially the hind tibiae; tibial setulae are irregularly arranged; the middle and the hind tibiae with a row of internal bristles; hind tibiae enlarged apically. Femora dusky yellow especially proximately and dorsally. First hind tarsal segment with two regular ventral rows of setae. Fore basitarsi longer than the fore tibiae (40:32).

Wings with R_4 ending in C. Membrane dusky with the anterior border dark, extending posteriorly to cell R_5; three hyaline spots in the anterior border, one at the base extending apically beyond the humeral cross-vein, the next beyond the tip of Sc, the third beyond the tip of R_4.

Halteres yellow, knob black.

Abdominal tergites black with yellow spots; the first to the fifth tergites yellow basally, the second to the fourth with central spots, smaller on the fourth. Second sternite with two large apical yellow spots on either side the mid-line; the third and the fourth sternites with two basal as well as two apical spots, the fifth and sixth sternites with two basal spots only.

Holotype.—♂; Swarthmore, Delaware County, Pennsylvania; August, (E. T. Cresson Jr.); [Acad. Nat. Sci. Phila. no. 6629].

Ceroplatus (Ceroplatus) striatus new species (Pl. XXIV, fig 13.)

There are but two other neotropical species in this subgenus, *Ceroplatus minimax* Edwards and *C. fiebrigi* Edwards. *C. fiebrigi* has but two ocelli. *C. minimax* has a brown spot on the fore coxae and the mesonotum brown without distinct brown marks above. This species has three ocelli, front coxae entirely yellow, and the mesonotum with spots above. The face is narrower than usual in this subgenus.

Male: Total length 8 mm. Head yellow; the three ocelli surrounded by a well defined black area; the antennae deep brown, the last segment minute; palpi yellow, porrect; face narrow.

Thorax yellow and brown. Mesonotum yellow anteriorly with a brown central spot, laterad of this a brown V-shaped mark with its apex directed posteriorly to the dorsum of the scutellum, elongate brown spots above the wing bases, lateral margins with brown stripes that connect anteriorly with the arms of the V. Pleura yellow with two prominent horizontal stripes; the upper stripe beginning on the cervical plates crossing the propleura, the lower end of the anepisternites, pteropleurites and the upper portion of the pleurotergites; the lower stripe covers the ventral portion of the sternopleurites and the pleurotergites. Scutellum yellow except the center above. Postnotum with its caudal face brown. Anepisternites setose; hypopleurites with a small group of setae. Coxae yellow, the mesocoxae and the metacoxae dark apically; the mesofemora and the metafemora dark basally; tibial setulae regularly arranged in rows.

Wings with R_4 ending in R_1. Wing membrane with clouds, the first over the base of R_s, the second extending from just before the tip of R_1 back into cell M_2 covering vein R_4 and almost completely covering cell R_4.

Abdomen swollen basally. The first through the seventh tergites are brown with lateral yellow spots, less prominent on the sixth and seventh tergites. Male terminalium yellow.

Holotype.—♂; Vera Cruz; (J. C. Crawford); [Acad. Nat. Sci. Phila. no. 6630].

PALAEOPLATYURA Meunier

Palaeoplatyura Meunier, Miscell. Ent., VI, p. 164, 1899. Johannsen, Gen. Insect., fasc. 93, p. 10, pl. 3, fig. 7 (*Mycetobiinae*), 1909. Johannsen, Maine Agr. Exp. Sta. Bull. no. 172, pp. 224–225, fig. 78 (*Mycetobiinae*), 1910. Edwards, Ann. Mag. Nat. Hist, (9), VII, p. 433 (*Ceroplatinae*), 1921. Edwards, Trans. Ent. Soc. London, 1924, pp. 522–523 (*Ceroplatinae*), 1925.

Key to Recent Species of Palaeoplatyura

1. Wing with distinct markings, anal vein reaches the wing margin; male terminalium as in plate XXIV, figures 18 and 22....*johnsoni* Johannsen
   Wing hyaline with its tip faintly smoky, never with distinct markings...2
2. Anal vein does not reach the wing margin, R_4 ends in C beyond the tip of R_1; mesonotal setae black; male terminalium as in plate XXIV, figures 16 and 17..............................*aldrichii* Johannsen
   Anal vein reaches the wing margin, R_4 ends in R_1 at the tip of R_1; mesonotal setae yellow; male terminalium as in plate XXIV, figures 15 and 19.......................................*melanderi* new species

Palaeoplatyura aldrichii Johannsen (Pl. XXIV, figs. 16 and 17.)

Palaeoplatyura aldrichii Johannsen, Gen. Insect, fasc. 93, p. 10, 1909. Johannsen, Maine Agr. Exp. Sta. Bull., no. 172, p. 225, 1910.

WASHINGTON: Bellingham, Whatcom Co., July 30, (A. L. Melander), 1 ♀?, A.L.M. Friday Harbor, San Juan Island, San Juan Co., (J. M. Aldrich), [Johannsen, 1909, 1910], 1 ♂, *type*, U.S.N.M. Mt. Constitution, Orcas Island, San Juan Co., June 9, (A. L. Melander), 1 ♂, A.L.M.

Palaeoplatyura johnsoni Johannsen (Pl. XXIV, figs. 19 and 22.)

Palaeoplatyura johnsoni Johannsen, Maine Agr. Exp. Sta. Bull., no. 172, pp. 225–227, fig. 78, 1910. Leonard, Cornell Univ. Agr. Exp. Sta., Mem. no. 101, p. 740, 1928. Shaw, Bull. Brook. Ent. Soc., XXXVI, p. 24, 1941.

VERMONT: Burlington, Chittenden Co., June 24, (C. W. Johnson), [Johannsen, 1910; Johnson, 1925], 1 defective specimen, *type*, B.S.N.H.

MASSACHUSETTS: Petersham, Worchester Co., June 9, (A. L. Melander), 2 ♂, A.L.M. and A.N.S.P. Sunderland, Franklin Co., May 24, 1 ♂, B.S.N.H. Lake May, June 13, (C. P. Alexander), 1 ♂, B.S.N.H. Great Barrington, Berkshire Co., June 15, [Johnson, 1925], 1 ♂, B.S.N.H.

NEW YORK: Filmore Glen, near Moravia, Cayuga Co., June 15, (E. G. Fisher), 1 ♂, A.N.S.P. Ithaca, Thompkins Co., June, [Leonard, 1928], C.U.

MARYLAND: Loch Raven, Baltimore Co., May 8, (E. G. Fisher), 2 ♂, A.N.S.P.

NORTH CAROLINA: *Great Smoky Nat. Pk., June 10, (C. P. Alexander), Shaw Coll.

Palaeoplatyura melanderi new species (Pl. XXIV, figs. 15 and 19.)

This species is close to *Palaeoplatyura aldrichii* Johannsen differing as indicated in the key above.

Male: Total length 7 mm., wing 4.8 mm. Head brown to black above; face yellow. Antennal flagellum except the basal joint dark brown, scape and base of the flagellum and the palpi yellow. The palpi slender, the last joint slender and elongated. Three ocelli, the middle one smallest. Thorax yellow, setae yellow. Mesonotum yellow, sometimes with a narrow dark brown median stripe posteriorly and brown before the scutellum. The postnotum dark brown to blackish; scutellum yellow. Wings hyaline, Sc ending in C beyond the level of the origin of R_s; Sc_2 well before halfway between the humeral cross-vein and the tip of Sc; sometimes faint to absent. R_4 ending distinctly in R_1 very close to the tip of R_1; r–m cross-vein very short but distinct, basal section of M very delicate and transparent to almost invisible; stalk of M and m–cu subequal. Second anal vein reaches the wing margin. Halteres yellow. All trochanters with black spots below. Tibial setulae irregularly spaced; small scattered setae on all aspects. Abdomen brown above, yellow below except apically entirely brown; narrow hind margins of the tergites white. Terminalium yellow, ninth tergite brownish, tips of styles black.

Holotype.—♂; Tahoma Fork, Mt. Ranier, Pierce County, Washington; July 25; [Acad. Nat. Sci. Phila. no. 6631].

Paratypes.—17 ♂; Index, Snohomish Co., August 2; Canyon Creek, Snohomish Co., July 25; Lake Cushman, Mason Co., July 22; Lilliwaup, Mason Co., July 23; Olymphia, Thurston Co., June 22; Tahoma Fork, Mt. Ranier, Pierce Co., July 25; Hansen Camp, Mt. Ranier, Pierce Co., July 31; Naselle, Pacific Co., July 2; Ilwaco, Pacific Co., June 28; Pluvius, Pacific Co., July 16.

All specimens were collected by Dr. A. L. Melander in Washington. Paratypes are deposited in the Melander collection and in the collection of the Academy. I take pleasure in naming this species after the collector.

HESPERODES Coquillett

Hesperodes Coquillett, Ent. News, xi, p. 429, 1900. Johannsen, Maine Agr. Exp. Sta., Bull. no. 172, p. 241, 1910.

There is but on described species of which I know only two specimens.

Hesperodes johnsoni Coquillett, Ent. News, XI, p. 429, 1900. Smith, Ann. Rept. N. J. State Mus. for 1909, p. 725, 1910. Johannsen, Maine Agr. Exp. Sta., Bull. no. 172, p. 241, 1910.

MASSACHUSETTS: Wellesley, Norfolk Co., June 30, 1 ♀, A.N.S.P.

NEW JERSEY: Delaware Water Gap, Warren Co., July 12, (C. W. Johnson), [Coquillett, 1900; Smith, 1910; Johannsen, 1910], 1 ♂, *type*, U.S.N.M.

The holotype, a male, has simple styles as in *Macrocera*. The ocelli are lacking in both sexes.

PLATYURA Meigen[13]

Platyura Meigen (not authors), Illiger's Mag. f. Insek., II, p. 264, 1803.

Apemon Johannsen, Gen. Insect., fasc. 93, p. 20, 1909, Johannsen, Maine Agr. Exp. Sta., Bull. no. 172, pp. 241–245, figs. 88, 97, 1910. Edwards, Trans. Ent. Soc. London, 1924, p. 526, 1925.

Paraplatyura Enderlein, Stett. Ent. Zeit., LXXII, p. 163, 1910.

Key to Nearctic Species of Platyura[14]

1. Sc short, ending at or before the base of R_s..........................2
Sc long, ending distad of the base of R_s..............................3
2. Total length 6 mm.; abdomen yellow with the anterior portion of each segment black, western species......................*gracilis* Williston
Total length 8–12 mm.; abdomen reddish yellow, first segment black *pectoralis* Coquillett
3. Mesonotum black or reddish with brown stripes......................4
Mesonotum and abdomen reddish yellow, the first segment black; narrow wing cloud along R_s; cloud from C covering R_4 and extending into the base of cell M_2; another diffuse cloud from just before the tip of R_5 to just beyond the tip of Cu_1; western *pectoralis* Coquillett (*rufa* Van Duzee)
4. Abdomen almost wholly black.......................................5
Abdomen in part reddish yellow.....................................6
5. Wings with a deep black cloud which extends from midway between Sc and R_1, pass vein M_{1+2} and at the margin of the wing passes vein M_3 *manteri* (Johnson)
Wings of male very faintly smoky, of female more distinctly smoky but never as above............................*nigriventris* (Johannsen)
6. Mesonotum black, or black with a triangle back of the humerus and the dorso-pleural suture yellowish....................................7
Mesonotum reddish yellow with three dark brown stripes; part of the third, fourth, and fifth abdominal segments yellow, the other segments black...*pulchra* Williston

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[13] Synonymy after Stone, Ann. Ent. Soc. Amer., XXXIV, pp. 407, 415, 1941.

[14] Partly after Johannsen, 1910. *Apemon maudae* and *A. pulchra* have been reversed in Johannsen's key.

7. Mesonotum black; abdomen yellow except the first two segments *maudae* Coquillett

Mesonotum black usually with a yellow triangle back of the humerus (not in a paratype in M.C.Z.) and the dorso-pleural suture yellowish; abdomen with the first and second segments black, then a varying number of red segments and the caudal end of the abdomen black *similis* (Johnson)

Platyura gracilis Williston

Platyura gracilis Williston, Kansas Univ. Quart., II, p. 60, 1893.

Apemon gracilis Johannsen, Gen. Insect., fasc. 93, p. 20, 1909. Johannsen, Maine Agr. Exp. Sta., Bull. no. 172, p. 243, 1910.

WASHINGTON:* (S. W. Williston), [Williston, 1893], 1♂, *type*, Univ. of Kansas.

Platyura pectoralis Coquillett

Platyura pectoralis Coquillett, Canad. Ent., XXVII, pp. 199–200, 1895.

Apemon pectoralis Johannsen, Gen. Insect., fasc. 93, p. 20, 1910. Johannsen, Maine Agr. Exp. Sta., Bull. no. 172, p. 243, fig. 88, 97, 1910. Cole and Lovett, Proc. Calif. Acad. Sci., (4), XI, p. 217, 1921.

? *Apemon rufa* Van Duzee, Proc. Calif. Acad. Sci, (4), XVII, pp. 32, 33, 1928.

Coquillett's type is described as a female; the type is a male.

Van Duzee, 1928, states that Johannsen's *Nevada* males of *Apemon pectoralis* Coquillett are the same species as his *Apemon rufa.* He must have meant the *Idaho* males. Coquillett's holotype is from Nevada and the specimens that Johannsen described are from Idaho. All of these specimens are in the U.S.N.M. and I consider them conspecific in spite of the difference in the ending of Sc_1. One specimen is smaller than the others as was pointed out by Johannsen, but I agree with him that these are all conspecific.

Van Duzee's description fits perfectly with Johannsen's, Coquillett's and Cresson's specimens. Of the specimens I have seen one specimen shows a slight variation in the position of the ending of Sc_1 in relation to the base of R_s; the slant of R_4 varies in Cresson's specimens; the tarsi are brown in all specimens. The metanotum varies from entirely black to yellow with black only on the posterior face; pronotal color entirely black or black with red on its upper half.

I have not seen Van Duzee's holotype so list his species as a synonym with a question.

IDAHO: Troy, Latch Co., May 31, (E. T. Cresson Jr.), 1 ♂, 1 ♀, A.N.S.P. Moscow, Latch Co., June 27, (J. M. Aldrich), [Johannsen, 1910; Van Duzee, 1928 as *A. rufa,* in error as "Nevada males"], 1 ♂, 1 defective specimen, U.S.N.M. Grangeville, Idaho Co., June 27, (J. M. Aldrich), [Johannsen, 1910; Van Duzee, 1928 as *A. rufa,* in error as "Nevada males"], 1 ♂, 1 defective specimen, U.S.N.M.

WASHINGTON:* North Bend, King Co., July 10, (E. C. Van Dyke), [Van Duzee, 1928 as paratype of *A. rufa*], 1 ♀, C.A.S. Ilwaco, Pacific Co., June 28, (A. L. Melander), 1 ♀, A.L.M.

OREGON:* Corvallis, Benton Co., June 4, [Cole and Lovett, 1921], Oregon Agricultural College Collection?

NEVADA: [Coquillett, 1895; Johannsen, 1910], 1 ♂, *type,* U.S.N.M.

CALIFORNIA:* Sobre Vista, Sonoma Co., (J. A. Kusche), 2 ♀, C.A.S. *Lagunitas, Marin Co., April 26, (E. P. Van Duzee), [Van Duzee, 1928 as *A. rufa,* paratype], 1 ♂, C.A.S. *Mill Valley, Marin Co., April 11–18, (M. C. and E. P. Van Duzee), [Van Duzee, 1928 as type and paratype of *A. rufa*], 1♀, 1 ♂, C.A.S. *Yosemite Valley, Yosemite National Park, June 10, (E. C. Van Dyke), [Van Duzee, 1928 as allotype of *A. rufa*], 1 ♂, C.A.S.

Platyura maudae Coquillett (Pl. XXIV, fig. 28.)

Platyura maudae Coquillett, Canad. Ent., XXVII, p. 199, 1895.
Apemon maudae Johannsen, Gen. Insect., fasc. 93, p. 20, 1909. Johannsen, Maine Agr. Exp. Sta., Bull. no. 172, p. 244, 1910. Cole and Lovett, Proc. Calif. Acad. Sci., (4), XI, p. 217, 1921.

WASHINGTON: No further data, [Coquillett, 1895], 1 defective specimen, *type,* U.S.N.M. 1 ♂, *co-type?,* U.S.N.M. Canyon Creek, Snohomish Co., July 26, (A. L. Melander), 1 ♂, A L.M. Ilwaco, Pacific Co., June 28, (A. L. Melander), 3 ♂, A.L.M. and A.N.S.P.

OREGON: Corvallis, Benton Co., May 5, [Cole and Lovett, 1928], 1 ♂, U.S.N.M. *Others same data, May 3–30, [Cole and Lovett, 1928], Oregon Agricultural College Collection?

Johnson's specimens (1925) belong to *P. similis.*

Platyura pulchra Williston

Platyura pulchra Williston, Kansas Univ. Quart., II, p. 59, 1893.
Apemon pulchra Johannsen, Gen. Insect., fasc. 93, p. 20, 1909. Johannsen, Maine Agr. Exp. Sta., Bull. no. 172, pp. 244–245, 1910.

This species, represented apparently only by the holotype, is unknown to the author.

WASHINGTON:* [Williston, 1893], 1 ♂, *type,* Univ. of Kansas.

Platyura manteri (Johnson)

Apemon manteri Johnson, Psyche, XXXVIII, p. 23, 1931.

CONNECTICUT: West side of Williamatic River near Mansfield Station, Tolland Co., June 6, (C. W. Johnson), [Johnson, 1931], 1 ♂, *type*, B.S.N.H.

Platyura nigriventris (Johannsen) (Pl. XXIV, fig. 21.)

Apemon nigriventris Johannsen, Maine Agr. Exp. Sta., Bull. no. 172, p. 245, 1910.

BRITISH COLUMBIA: Prairie Hill, (5,800′), July, (J. C. Bradley), [Johannsen, 1910], *co-type*, O.A.J. Selkirk Mts., Rogers Pass, (4,600′), (J. C. Bradley), [Johannsen, 1910], *co-types*, O.A.J. and C.U. Kalso, June 18, 20–29, July 12, (R. P. Currie, H. G. Dyar, A. N. Caudell), 4 ♂, 2 ♀, U.S.N.M. as *Platyura marginata* Meigen.

MONTANA: Avalanche Lake, Glacier Nat. Park, July 14, (A. L. Melander), 1 ♀, A.L.M.

IDAHO: Troy, Latch Co., May 31, (E. T. Cresson Jr.), 1 ♂, A.N.S.P.

WASHINGTON: Diamond Lake, Pend Oreille Co., June 15, (A. L. Melander), 2 ♂, A.L.M. and A.N.S.P. S. Fork Dry Creek, Blue Mts., Columbia Co.?, June 27, (V. N. Argo), 1 ♂, A.L.M. White River, Mt. Ranier Nat. Park, July 19, (A. L. Melander; on *Heracleum* sp.), 1 ♂, A.L.M.

Platyura similis (Johnson) (Pl. XXIV, fig. 24.)

Apemon maudae Johnson (nec Coquillett), Occas. Pap. Boston Soc. Nat. Hist., VII, p. 77, 1925.

Apemon similis Johnson, Psyche, XXXVIII, pp. 22–23, 1931.

QUEBEC: Chelsea, 1 ♂, C.U.

MAINE: Oquossoc, Rangeley Lake, Franklin Co., July 3, (C. W. Johnson), [Johnson, 1931], 1 ♀, *paratype*, M.C.Z.

NEW HAMPSHIRE: Bretton Woods, June 28, (C. W. Johnson), [Johnson, 1925 as *A. maudae;* Johnson, 1931], 1 ♂, *type*, B.S.N.H. Franconia, Grafton Co., (Mrs. A. T. Slosson), [Johnson, 1925 as *A. maudae;* Johnson, 1931], 1 ♀, *allotype*, B.S.N.H. Tucherman Ravine, Mt. Washington, Coos Co., July 8, (July 28 in Johnson), (3,000′), [Johnson, 1925 as *A. maudae;* C. W. Johnson, 1931], 1 defective specimen, *paratype*, B.S.N.H. Halfway House, Mt. Washington, Coos Co., July 4, (C. W. Johnson), 1 ♀, M.C.Z.

The number of reddish-yellow abdominal segments varies.

EXPLANATION OF FIGURES

PLATE XXIII

Fig. 1.—*Ditomyia potomaca* new species. Dorsal aspect of male terminalium of holotype.

Fig. 2.—*Symmerus coqulus* Garrett. Lateral aspect of male terminalium (styles swollen by treatment with KOH solution). (Compared with metatype.)

Fig. 3.—*Diadocidia borealis* Coquillett. Style of unprepared male terminalium (compared with unprepared style of holotype).

Fig. 4.—*Symmerus lautus* (Loew). Lateral aspect of male terminalium; the dorsal to the right. 4a. mesal aspect of style tip (figures compared with holotype).

Fig. 5.—*Diadocidia ferruginosa* (Meigen). Lateral aspect of male terminalium.

Fig. 6.—*Diadocidia ferruginosa* (Meigen). Ventral aspect of male terminalium (agree with European figures).

Fig. 7.—*Ceroplatus militaris* Johannsen. Lateral aspect of male terminalium (compared with holotype).

Fig. 8.—*Ceroplatus militaris* Johannsen. Ventral aspect of male terminalium.

Fig. 9.—*Ceroplatus clausus* Coquillett. Ventral aspect of male terminalium (compared with holotype).

Fig. 10.—*Ceroplatus clausus* Coquillett. Dorsal aspect.

Fig. 11.—*Ceroplatus johannseni* Fisher. Dorsal aspect of male terminalium (half) of holotype.

Fig. 12.—*Ceroplatus militaris* Johannsen. Dorsal aspect of male terminalium (figure compared with holotype).

PLATE XXIV

Fig. 13.—*Ceroplatus striatus* new species Dorsal aspect of male terminalium of holotype.

Fig. 14.—*Ceroplatus cressoni* new species. Ventral aspect of male terminalium of holotype

Fig. 15.—*Palaeoplatyura melanderi* new species. Dorsal aspect of half of male terminalium of holotype

Fig. 16.—*Palaeoplatyura aldrichii* Johannsen. Dorsal aspect of half male terminalium.

Fig. 17.—*Palaeoplatyura aldrichii* Johannsen. Ventral aspect

Fig. 18.—*Palaeoplatyura johnsoni* Johannsen. Dorsal aspect of half of male terminalium.

Fig. 19.—*Palaeoplatyura melanderi* new species. Ventral aspect.

Fig. 20.—*Platyura pectoralis* Coquillett (*rufa* Van Duzee). Dorsal aspect of half of male terminalium of an Idaho specimen.

Fig. 21.—*Platyura nigriventris* (Johannsen). Dorsal aspect of half of male terminalium.

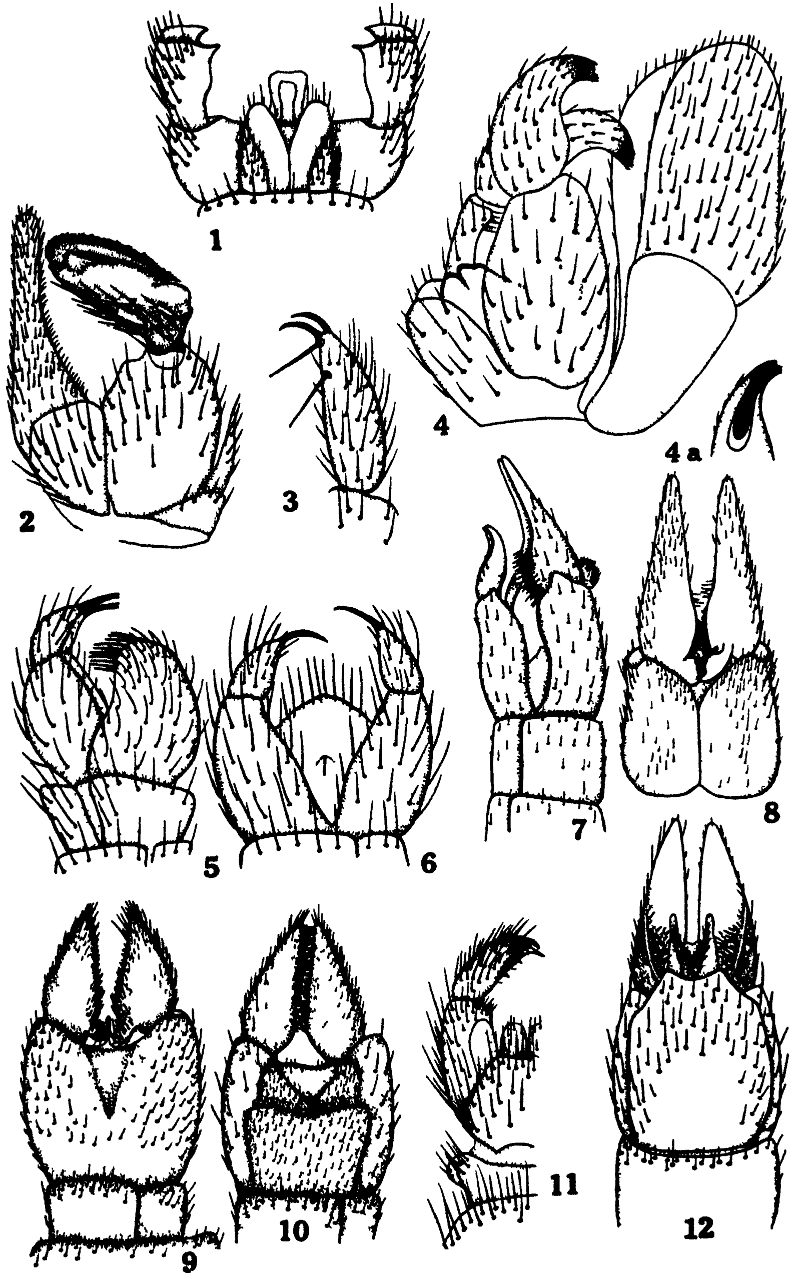
Fig. 22.—*Palaeoplatyura johnsoni* Johannsen. Ventral aspect of half of male terminalium.

Fig. 23.—*Platyura similis* (Johnson). Dorsal aspect of half of male terminalium.

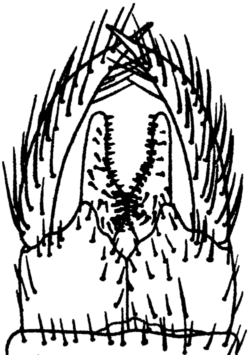
Fig. 24.—*Platyura maudae* Coquillett Dorsal aspect of unprepared male terminalium.

Fig. 25.—*Ditomyia euzona* Loew. Dorsal aspect of unprepared male terminalium of holotype.

Plate XXIII.



FISHER—AMERICAN MYCETOPHILIDAE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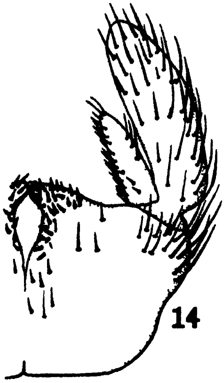
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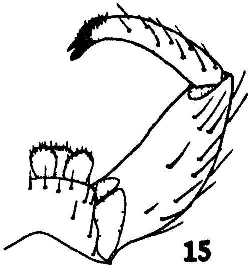
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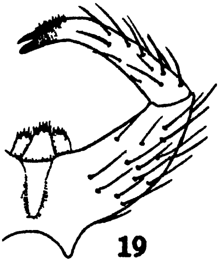
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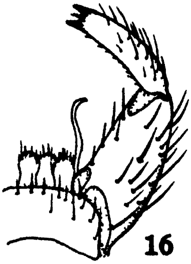
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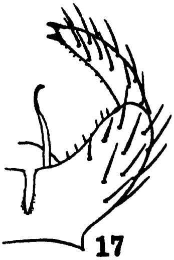
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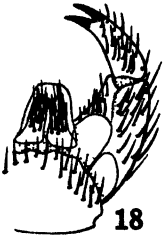
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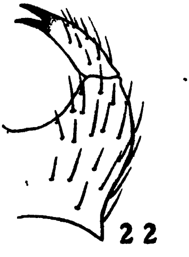
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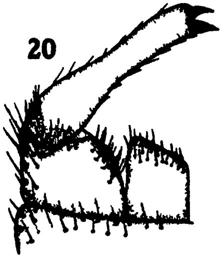
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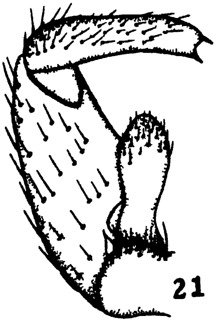
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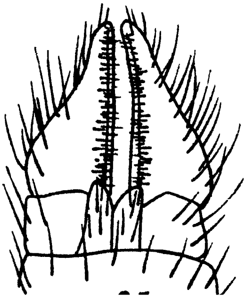

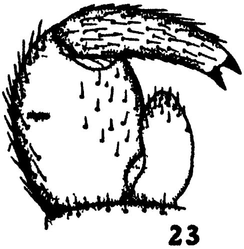
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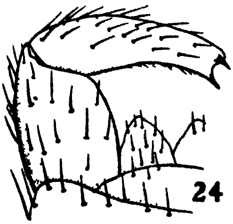
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FISHER—AMERICAN MYCETOPHILIDAE

NEW AND LESS KNOWN SOUTHERN PALAEARCTIC ORTHOPTERA[1]

BY B. P. UVAROV

British Museum (Natural History)

(Plates XXV–XXIX)

The following notes and descriptions are based on the material which has been accumulating in the British Museum during the last few years. The greater percentage of the new and insufficiently known genera and species have been found among the collections made by Mr. M. N. Korsakoff in Algeria and by Mr. O. S. Grebenchikoff in Greece. Both these naturalists rendered great services to the Museum by their methodical collecting conducted on an ecological basis, and it is my pleasant duty to put on record their achievements. It should be added that the study of their collections is still incomplete, and further interesting species may be expected amongst them. The paper includes also revisionary notes on other less known Palaearctic Orthoptera.

Sixty-one forms of twenty-seven genera are here discussed, seven genera are wholly or in part reviewed, twenty new species and subspecies are described and eight cases of new specific synonymy established.

The types of the new species are in the British Museum, unless stated otherwise. Measurements given for new species are of the type, and if more than one sex is represented, of a paratype of the opposite sex.

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[1] The publication of this paper in Great Britain would have been inevitably delayed owing to the war, and the author wishes to record his deep appreciation of the hospitality extended to it by the American Entomological Society.

Issued February 19, 1942

GRYLLIDAE

Gryllomorpha algeriana new species (Pl. XXV, figs. 1 and 2)

Type.—♂; Bou-Saada, Algeria. October, 1937. (M. N. Korsakoff.) [British Museum (Natural History).]

A small, pale-coloured species, closely applied to *G. uclensis* Pantel, 1891, described from Central Spain, but well distinct from it in the structure of appendages of the male supra-anal plate. This difference can be seen clearly when comparing figure 1, showing the dorsal aspect of the supra-anal plate in *G. algeriana* and figure 2, a single appendage viewed from inside, with the corresponding figures for the type of *G. uclensis* (Figs. 3 & 4), kindly sent me by Dr. L. Chopard. The posterior margin of the supra-anal plate, between the appendages, is shown in both figures by dotted lines, as the plate here is very soft and liable to folding. The appendages, however, are well sclerotised and their relative size and shape is certainly of taxonomic value. It should be noted that Pantel's original figures [2] do not reproduce the shape of the appendages very exactly and Chopard's figure [3] is either inexact, or based on a different species.

As regards colouration and other morphological characters the Algerian species agrees very closely with *G. uclensis,* being slightly larger in size than the only specimen of the latter examined by me. I find it, therefore, unnecessary to give a detailed description of the new species, which is based on 2 ♂ (including the type) and 2 ♀ from Bou-Saada, X, 1937; 2 ♀ from Bou-Saada, IX, 1938; and 2 ♂, 7 ♀ from Djelfa, X, 10–17, 1938. (M. N. Korsakoff.)

This is, probably, the species recorded from Algeria and Tunisia as *G. uclensis* by Finot,[4] but I am unable to agree with I. Bolívar [5] who has suggested that Finot's species might be identical with *G. gestroana* I. Bolívar, 1914, of Tripoli. The last named species was based on a female only, but it has a very different type of posterior tarsus, which is very slender and armed with claws almost as long as the terminal segment of the tarsus. The tarsus in *G. algeriana* is stout and its claws are equal to about half of the terminal segment.

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[2] An. Soc. Esp. Hist. Nat., XIX, pl. 3, figs. 5A, 5B, 1891.

[3] Faune de France, Orth., p. 98, fig. 278.

[4] Ann. Soc. Ent. France, 1895, p. 573.

[5] Mem. Soc. Esp. Hist. Nat., VIII, p. 222, 1914. (Footnote.)

TETTIGONIIDAE

Amphiestris baetica (Rambur, 1839)

This remarkable Tettigoniid has been recorded in taxonomic literature as occurring in Andalusia and in few localities of western Algeria, but is apparently more widely distributed in the latter country, where it is well known to natives under the name "bou-bzibi" and occasionally appears in such numbers that it becomes a pest of cultivated plants.[6] The most eastern occurrence known to me is Bouira in the Djurdjura mountains, where a series of specimens was collected by Mr. Korsakoff on VII, 7, 1939.

Paratlanticus uvarovi (Miram)

1940. *Paradrymadusa uvarovi* Miram, Trav. Inst. Zool. Acad. Sci. URSS, VI, (1–2), p. 61, figs. 1–3.

As stated in the preface to the volume in which the description has been published, the volume was ready for publication in 1937, but its appearance was delayed, for technical reasons, until 1940. This accounts for the inclusion of the present species in *Paradrymadusa,* while it certainly belongs to the genus *Paratlanticus* Ramme 1939,[7] erected in the meantime for *Atlanticus ussuriensis,* with which *P. uvarovi* is compared by Miram.

CALOPTERUSA new genus

Ramme in his preliminary revision of the group Drymadusae[8] has restricted the genus *Paradrymadusa* Herman, 1874 (genotype, *P. sordida* Herman, 1874) to four species forming a very compact and well defined genus, while a number of other species, described under the genus *Paradrymadusa,* have been removed to various new genera. Three species, however, have been left in *Paradrymadusa* tentatively, mainly because Ramme had no specimens before him. These are *P. werneri* Adelung, 1910, *P. balucha* Uvarov, 1929, and *P. pastuchovi* Uvarov, 1917. The last named species has been described from the male sex alone, and no specimens are available to me; its generic position remains, therefore, uncertain. As regards *P. werneri* and *P. balucha,* they are certainly closely related and both exhibit a number of features alienating them from the genus *Paradrymadusa* as restricted by Ramme. Therefore a new genus must be erected to include them, with the following diagnosis.

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[6] See "La lutte contre les sauterelles en Algerie" published by the Government General of Algeria, 1922.

[7] Mitt. Zool. Mus. Berlin, XXIV, p. 90.

[8] Mitt. Zool. Mus. Berlin, XXIV, p. 70, 1939.

Size medium for the group; habitus moderately robust; general colouration light-buff to light-brown, surface rather shiny; elytra with thick pure white membrane and striking network of black veins and veinlets; face without black fascia. Fastigium of vertex wider than the first antennal joint. Pronotum extended backwards, with the hind margin rounded-truncate; lateral lobe with distinct humeral sinus. Prosternum entirely unarmed, even without lateral angles; mesosternal lobes very short, broadly rounded; metasternal lobes practically absent. Elytra very short; membrane thick; veins and veinlets callous, thick.

Last tergite of male with a pair of acute lobes; cercus flattened, truncate, with a short, thick curved tooth at the inner apical angle. Female subgenital plate longer than wide, with excised apex. Ovipositor long, weakly decurved.

GENOTYPE: *Paradrymadusa werneri* Adelung, 1907.

The new genus differs from *Paradrymadusa* particularly in the structure of the sternum, in which respect it appears to be the least specialised member of the group Drymadusae, the other extreme being represented by the genus *Drymadusa,* in which the prosternum is armed with a pair of long slender spines, and both mesosternal and metasternal lobes also end in spines. These sternal characters were neglected by Ramme, but they are undoubtedly important from a taxonomic point of view. Further differences of *Calopterusa* from *Paradrymadusa* consist in the structure of both male and female genitalia; in the unusual texture and colouration of elytra; and in the absence of black fascia on the upper part of face.

As stated above, *Calopterusa* should include, apart from the genotype, also *Paradrymadusa balucha* Uvarov, 1932. That species has been described from Dasht in Baluchistan, and I have now before me another male also from Baluchistan, Wam Kotal, 5000 ft., V, 4, 1931 (D. Harrison). The female is still unknown, but it is improbable that its characters will be found to diverge from the generic diagnosis.

It appears probable that *Paradrymadusa bocquilloni* Uvarov, 1917 should be also referred to *Calopterusa,* although I have no specimens before me at present. Ramme[9] has included this species in his genus *Phytodrymadusa,* but he himself pointed out the uncertainty of that arrangement. The unarmed prosternum and short, coloured elytra of *P. bocquilloni* are characteristics of *Caloptერusa*, but not of *Phytodrymadusa.*

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[9] Mitt. Zool. Mus. Berlin, xxiv, p. 80, 1939.

IRANUSA new genus

The group Drymadusae includes four genera with species possessing fully developed, or only moderately abbreviated, elytra and wings, viz. *Drymadusa* Stein, 1861, *Ceraeocercus* Uvarov, 1910, *Afrodrymadusa* Ramme, 1939, and *Ferganusa* Uvarov, 1926. I have before me now two fully winged females which are obviously congeneric, but not conspecific, and which cannot be referred to any known genus. Their characters are sufficiently well marked for describing a new genus even in the absence of the male sex, which probably will prove to possess further characters of generic value. The diagnosis of the new genus is, as follows:

Size medium for the group; of slender build, with relatively small head and pronotum and fully developed organs of flight; general colouration pale greyish-ochraceous with weakly pronounced grey pattern on the elytra; wings hyaline. Fastigium of vertex wider than the first antennal joint; no black fastigial fascia. Pronotum rounded above, extended backwards, with hind margin rounded; lateral lobe with distinct humeral sinus. Prosternum entirely unarmed, even without the lateral angles; mesosternal lobes as short as long, triangular; metasternal lobes shorter than long, rounded-triangular.

Elytra fully developed, extending beyond hind knees; relatively narrow. Anterior and median legs long and slender; median tibia particularly elongated and distinctly incrassate; posterior femur long, inflated in the basal half. Tarsus very slender.

Female subgenital plate about as long as wide; with two obtuse lobes. Ovipositor long, weakly decurved.

GENOTYPE: *Iranusa bampura* new species, here described.

The new genus differs from *Drymadusa* and *Ceraeocercus* in the slender habitus; completely unarmed prosternum; narrow and long elytra; hyaline wings; peculiarly elongated median legs and slender posterior tarsi. In its slender habitus and the type of colouration, *Iranusa* is somewhat similar to *Ferganusa,* but differs in the sternal structures; in the fastigium being normal for the group (while in *Ferganusa* it is very narrow and not widened above); in the structure of median legs and posterior tarsi; and in hyaline wings. The North African genus *Afrodrymadusa* is characterised by the upcurved ovipositor, which differentiates it from the other three winged genera.

There is a certain resemblance in the general habitus between *Iranusa* and *Scotodrymadusa* Ramme, 1939, if the development of flight organs is discounted. It would be impossible, however, to regard *Iranusa* merely as a *Scotodrymadusa* with fully developed wings, because of the primitive condition of prosternum in *Iranusa,* while in *Scotodrymadusa* it is at least provided with lateral angles; moreover, the ovipositor in the latter genus is upcurved. The structure of the prosternum in *Iranusa* might be compared only to that in *Calopterusa,* described above, but the latter differs in the still more primitive condition of mesosternum and metasternum, as well as in the development and colouration of elytra, and in the structure of legs.

Iranusa bampura new species (Pl. XXV, fig. 5)

Type.—♀; Karvandar village, Bampur Province, southwest Iran. April 25, 1901. (Zarudny.) [Zoological Institute of the Academy of Sciences, Leningrad.]

♀. Of medium size. General colouration greyish-ochraceous; elytral pattern brownish-grey, similar to that in *Platycleis*, but very weak. Anterior femur with three small spinules along the inner lower margin; median femur with four spinules; posterior femur with four spinules on the outer lower margin and two on the inner.

Last sternite in the type somewhat damaged, but appears rather large, with a weak oval convexity in the posterior part. Subgenital plate with a shallow emargination behind, with short rounded weakly concave lobes, and with a very weak median ridge near base.

Measurements.—Length of body, 40; pronotum, 9; elytra, about 4.5 (incomplete); median femur, 11.5; median tibia, 15; posterior femur, 32; posterior tibia, 33; ovipositor, 25 mm.

The type is the only specimen seen.

Iranusa khorasana new species (Pl. XXV, fig. 6)

Type.—♀; Turbet-i-Khaidari, Khorasan Province, northern Iran. July 3, 1927. (L. Moritz.) [Zoological Institute of the Academy of Sciences, Leningrad.]

♀. Considerable smaller than the genotype, *I. bampura;* dusty grey, with weak greyish elytral pattern. Anterior femur with two spinules on the inner lower margin; median femur with one; posterior femur with three on the outer and one on the inner lower margin.

Last tergite transverse, weakly globose. Subgenital plate lyre-shaped, with relatively narrow, weakly convex lobes.

Measurements.—Length of body, 27; pronotum, 7.5; elytra, 30; median femur, 9.5; median tibia, 12; posterior femur, 28; posterior tibia, 29; ovipositor, 20 mm.

The type is unique.

Algero-Tunisian Species of the Genus Rhacocleis Fieber

The following species of *Rhacocleis* have been so far reported from Algeria and Tunisia:

Rhacocleis annulata Fieber. This is a Sicilian species recorded by Finot[10] from the island of Galita, off the Tunisian coast, and from the environs of Tunis. Later, Vosseler[11] recorded it from Hammam el Lif in Tunisia and from Saida in Algeria. Finot gave a lengthy re-description of the species, but his statement: "Faute d'individus provenant de Tunisie, la description a été faite sur les types de Falcon (Sicile)," makes it impossible to decide whether his determination of the Tunisian specimens was correct. Indeed, it is certain that at least the Galita specimens should be referred to a very distinct species (see below), and this throws doubt on the correctness of his other record. Vosseler's record also requires careful checking, since he says that only a few of his specimens were adult. I am, therefore, inclined to doubt the occurrence of *R. annulata* in North Africa.

Rhacocleis neglecta Costa is a species originally described from Calabria and known also from Sicily. Finot[12] recorded it from Oran and Tlemcen in Algeria, but his description of the male cercus and of the female subgenital plate disagrees with Ramme's figures of *R. neglecta* from Sicily,[13] and should probably be referred to *R. korsakovi* sp.n. described below. The same applies to I. Bolivar's record[14] which was based on Finot's specimens; their identity with *R. neglecta* appeared doubtful to that author. Werner's records of *R. neglecta* from Algeria[15] must be rejected as they were based on larvae.

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[10] Ann. Soc. Ent. France, LXV, p. 516, 1896.
[11] Zool. Jahrb., Syst., XVI, p. 396, 1902.
[12] Ann. Soc. Ent. France, LXV, p. 517, 1896.
[13] Eos, III, p. 151, 1927.
[14] Bol. Soc. Esp. Hist. Nat., 1905, p. 344.

Rhacocleis maura Bonnet was described[16] from Ain-Dramah in Tunisia, and I. Bolívar[17] supplied notes on typical specimens, calling the species *R. gessardi* Bonn. obviously by mistake for *maura,* since on p. 346 he discussed the true *gessardi* which is a *Pterolepis.* I have once identified with Bonnet's species some specimens from Galita Island, belonging to the lot recorded by Finot under the name *R. annulata* (see above), and presented figures of male genitalia.[18] At the same time, I described a new species, *R. algerica* Uv., from Bone, Algeria, also illustrating the genitalia.[19] Recently, Morales published[20] the results of his examination of syntypes of *R. maura* Bonn. and proved that *R. algerica* Uv. is a pure synonym, while the species re-described by me as *R. maura* is quite distinct and was named by him *R. uvarovi* Morales. Since, however, a species of this name (*R. uvarovi,* Ramme)[21] already existed, I here rename the Galita species *Rhacocleis galitana* new name for *R. uvarovi* Morales, 1940 (nec *R. uvarovi* Ramme, 1936).

There are, therefore, only three species of *Rhacocleis* definitely known from Algeria and Tunisia, and the following key may be used to separate them:

1(4). Large: pronotum 8–9 mm., hind femur 24–30 mm. Male cercus very slender, six to eight times as long as its post-basal hook. Female seventh sternite with a strong tubercle. Lateral pronotal lobes in dark coloured individuals have a very broad pale border.

2(3). Male cercus eight times as long as its post-basal hook. Last tergite of male with a broad triangular excision broadly separating angular lobes. Female seventh sternite with a trapezoidal tubercle, the apex of which is emarginated. Female subgenital plate with a pair of small tubercles at its base. *maura* Bonnet

3(2). Male cercus six times as long as its postbasal hook. Last tergite of male with a narrow excision, the two very acute lobes touching each other. Female seventh sternite with a conical tubercle. Female subgenital plate without tubercles at the base (Fig. 7). *galitana* new species

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[15] Sitzber. Akad. Wiss. Wien., Mat.-nat. Kl., CXIII, (Abt. 1), p. 385, 1914.
[16] Le Naturaliste, VIII, p. 246, 1886.
[17] Bol. Soc. Esp. Hist. Nat., 1905, p. 344.
[18] Uvarov, Eos, XI, p. 73, fig. 1 M, 1935.
[19] Uvarov, Eos, XI, p. 73, fig. 1 A, 1935.
[20] VI Congr. Intern. Entom., Madrid, I, p. 87, 1940.
[21] Boll. Lab. Portici, XXIX, p. 134, 1936.

4(1). Small: pronotum 5 mm., hind femur 20 mm., ovipositor 18 mm. Male cercus (Fig. 9) short, stout, four times as long as its post-basal hook. Last tergite of male (Fig. 8) with broadly separated, acutely pointed short lobes. Female seventh sternite convex, but without tubercle. Female subgenital plate (Fig. 10) triangular, with a median carina and a pair of transverse basal lobes, followed by transverse depressions. Lateral pronotal lobes with sharply defined narrow pale border. *korsakovi* new species

Rhacocleis galitana new species (Pl. XXV, fig. 7)

1935. *Rhacocleis maura* Uvarov, Eos, XI, pp. 73, 74, fig. 1 M, (nec Bonnet, 1886).

1940. *Rhacocleis Uvarovi* Morales, VI. Congr. Intern. Entom., Madrid, I, p. 87, (nec Ramme, 1936).

Type.—♂; Galita Island, Tunisia. August, 1877. (Violanti, ex de Bormans coll.). [British Museum (Natural History).]

♂ (*type*). Large species, somewhat similar in the general appearance to *Pterolepis gessardi* Bonn.

General colouration blackish-brown, with pale stripes. Face testaceous, with a pair of small blackish spots. Fastigium of vertex in front buff, narrowly marginated with black, above with a broad castaneous stripe including a narrow pale line. Sides of head blackish, with a narrow postocular line. Pronotum strongly elongated behind; metazona with a low but distinct carinula; dorsal surface castaneous with two rather narrow pale stripes, weakly convergent in front of the middle and then divergent again; the space between them is castaneous, with irregular pale stripes; lateral lobe castaneous, with a broad pale spot occupying most of the metazona. Abdomen with the sides mainly brown, sharply separated from the light-buff broad dorsal stripe which includes three narrow and interrupted brown lines. Hind femur with a black spot at the base above, and a broad black stripe along the lower half of the outer side.

Genitalia as figured before (Uvarov, 1935).

♀ (*paratype*). Almost uniformly pale buff, with only a series of brown dots along the dorsum of abdomen, and a brown stripe of the hind femur.

Last sternite with a conical tubercle. Subgenital plate (Fig. 7) intersected by a transverse furrow; median carina also interrupted beyond the middle, its apical portion strongly widened proximally; apex of the plate obtusely excised. Ovipositor practically straight.

Measurements.—Length of body, ♂ 23, ♀ 24; pronotum, ♂ 9, ♀ 9; elytra, ♂ 3, ♀ 1; hind femur, ♂ 26, ♀ 28; ovipositor, ♀ 13 mm.

Described from 1 ♂ (type), 1 ♀ (paratype), both bearing the same data and now in the British Museum (Natural History).

Rhacocleis korsakovi new species (Pl. XXV, figs. 8, 9, 10)

Type.—♂; El-Behra Station, south of Constantine, Algeria. July 2–3, 1939. (M. N. Korsakoff.) [British Museum (Natural History).]

No detailed description of *R. korsakovi* is offered here, since that given by Finot[22] for *R. neglecta* (nec Costa) refers to this species, while the details of its genitalia can be seen from the appended figures. The species, recognizable by the characters given in the preceding key, is known only from the type locality, two females (including the type), several larvae; and one female from Djelfa, 1000 m., X, 1938, (M. N. Korsakoff). It is named after its collector, an ardent naturalist and explorer of the North African fauna.

East Mediterranean Species of the Genus Rhacocleis

The following notes show the great confusion reigning amongst the species of *Rhacocleis* so far recorded from Greece and from islands of the Eastern Mediterranean and the Aegean Seas. The list includes the following names:

Rhacocleis germanica (Herrich-Schaeffer, 1840) has been recorded by several authors from the mainland of Greece and occurs also, according to Werner,[23] on some westernmost Aegean islands. I know specimens from the following localities: Taygetos (Brunner's specimens in the British Museum); Karaburun and Lembet in Macedonia (M. Burr); Mt. Chelmos; Mt. Parnassus; Kephalonia; Corfu; Iraklion and Samaria in Crete (O. Grebenchikoff).

Rhacocleis insularis Ramme, 1928,[24] described from the Cyclades; its synonym, according to Ramme,[25] is *R. emmae* Werner 1933, described from Seriphos.

Rhacocleis anatolica Werner, 1933,[26] from the island of Kos (Cos) is extremely badly described and figured.

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[22] Ann. Soc. Ent. France, LXV, p. 516, 1896.

[23] Sitzber. Akad. Wiss. Wien, Mat.-nat. Kl., CXLVI, (abt. 1), p. 110, 1937.

[24] Deut. Ent. Zeit., 1928. p. 302.

[25] Mitt. Zool. Mus. Berlin, XXIV, p. 52, 1939.

[26] Sitzber. Akad. Wiss. Wien, Mat.-nat. Kl., CXLII, (abt. 1), p. 195, 1933. See also t.c. CXLIII, p. 326, 1934.

Rhacocleis distinguenda Werner, 1934,[27] from Mytilene and Chios, and *R. agiostratica* Werner, 1937 [28] are, according to Ramme who has seen the types, based on larvae possibly of the same species. All these three species of Werner should be classified as unrecognisable, at least until topotypical adults can be studied.

To the above five species should be added *R. graeca* described below, and two Aegean species described by Ramme, which have to be discussed in detail owing to the incredible, and quite unnecessary, confusion caused by their author.

Rhacocleis uvarovi Ramme

1936. *Rhacocleis uvarovi* Ramme, in Jannone, Boll. Labor Portici, xxix, p. 134, pl. I, figs. 6, 7, 8, (nec *R. uvarovi* Ramme, 1939).

1939. *Rhacocleis silvestrii* Ramme, Mitt. zool. Mus. Berlin, xxiv, p. 52, fig. 5 S (Syn. nov.).

This species was discovered by Jannone and submitted for determination to Ramme, together with the following one. Ramme recognised them both as new and named the one from the islands of Rhodos, Scarpanto, Caso and Coo, as *R. uvarovi*, while that from the Calino group of islands received the name *R. silvestrii*. Jannone in 1936 published the name *R. uvarovi* Ramme and accompanied it by three photographs, one of which (female. in profile) shows the highly characteristic spine on the seventh sternite. There can be no doubt, therefore, that the name *R. uvarovi* Ramme should be considered valid as from 1936 and applied to the species with the spinose seventh sternite occurring on Rhodos, Scarpanto, Caso and Coo. This species is known to me from a pair collected in Caso and sent to me by Dr. Jannone in 1938 labelled as *R*. *uvarovi* Ramme.

In 1939, however, Ramme described the same spinose species under the name *R. silvestrii*, and to make matters still worse, recorded as its type locality the Telendo island of the Calino group, where only the second, non-spinose, species (provisionally called *R. silvestrii* in 1936) is known to occur. This latter species had in 1939 received the name *R. uvarovi* and its type locality was recorded as the Caso island whence only the spinose species is known! This means that in 1939 Ramme transposed not only the names provisionally given by him in 1936, but also the locality labels of his types. Since, however, the spinose species from Caso has been validly described as *R. uvarovi* Ramme 1936, this name should stand and *R. silvestrii* Ramme 1939 becomes its pure synonym.

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[27] Sitzber. Akad. Wiss. Wien, Mat.-nat. Kl., cxliii, p. 326, 1934.

[28] Sitzber. Akad. Wiss. Wien, Mat.-nat. Kl., cxlvi, (abt. 1), p. 101, 1937.

In its habitus, particularly the short and broad pronotum, as well as the unusually short and stout hind legs, *R. uvarovi* is very distinct from all known members of the genus. An additional feature is found in the armature of the front tibia, which bears on its upper side three external and one internal spine, while in all other species of the genus the numbers are four and two, respectively. It is probable that these differences are of generic value, but it appears wiser to refrain from erecting a new genus until the numerous species of *Rhacocleis* are better known.

Rhacocleis silvestriana new species

1936. *Rhacocleis silvestrii* Ramme, in Jannone, Boll. Lab. Portici, XXIX, p. 134, pl. 1, figs. 6, 7, 8, (nec *R. uvarovi* Ramme, 1939).

1939. *Rhacocleis uvarovi* Ramme, Mitt. Zool. Mus. Berlin, XXIV, p. 54, fig. 5 U, (nec *R. uvarovi* Ramme, 1936).

The 1936 reference to *R. silvestrii* contains only a list of localities, and the name did not become valid until 1939, when it has been applied, however, to the species already described under the name *R. uvarovi* Ramme 1936, of which it becomes a synonym. The non-spinose species from the Calino islands (though incorrectly recorded from the Caso) received in 1939 the name *R. uvarovi*, which was then preoccupied, and must be, therefore, changed.

Rhacocleis graeca new species (Pl. XXV, figs. 11, 12, 13)

A strikingly large species, resembling a member of the genus *Pterolepis*.

Type.—♀; Nauplia, Peloponnesus, Greece. August, 1938. (O. Grebenchikoff.) [British Museum (Natural History).]

♀ (*type*). Pronotum relatively somewhat shorter and broader than in *R. germanica* (H.-S.), the metazona being less extended backwards. Elytra scarcely visible from under the pronotum. Front tibia on the upper side with four external and two internal spines. Hind femur very long and slender, with about six strong spinules on each of the two lower carinae.

Abdomen ventrally with only six visible sternites, the sixth being greatly reduced and excised in the middle, while no seventh can be discerned. Subgenital plate (Fig. 11) very large, divided by a deep transverse fold into two parts; the basal part is elongate-trapezoidal and bears a pair of sinuate ridges converging to a point at the base under the margin of the sixth sternite; the surface between the ridges is concave; the apical part is elongate-elliptical, convex, with a small emargination at the apex. Ovipositor of the same shape as in *R. germanica.*

Colouration brownish-stramineous. Lower lateral margins of the fastigium of vertex narrowly black. Lateral pronotal lobes with a black-filled furrow parallel to the hind margin and fairly distant from it. Abdomen with indefinite brownish markings. Front and middle tibiae with black spots at the bases of their spines. Front and middle femora with black pre-apical rings. Hind femur with a black spot at the base above; the spines and their bases black.

♂ (*paratype*). Pronotum more truncate behind than in the female. Elytra reaching the middle of the first tergite.

Last tergite with a broad round emargination and rounded lobes (Fig. 12). Cercus (Fig. 13), of the type observed in *R. germanica,* but more slender; its basal appendage much longer, forming practically no angle with the body of the cercus, pointing almost directly forward and placed above the last tergite. Subgenital plate with a small rounded apical emargination.

Colouration mostly ivory-yellow, with striking black pattern of the kind observed in the darker specimens of *R. germanica,* i.e. with a light stripe along the middle of pronotum, black furrows, and black lateral lobes, with a broad light margin and light spots in the middle. Legs coloured as in the female. Abdomen with a series of large blackish spots on the sides of tergites.

Measurements.—Length of body, ♂ 21, ♀ 25; pronotum, ♂ 6.5, ♀ 9; elytra, ♂ 1.5, ♀ 0.5; hind femur, ♂ 18, ♀ 26 mm.

Described from the female type, and three males from Micaene, Peloponnesus, VII, 1938, (O. Grebenchikoff), all in the British Museum (Natural History).

This remarkable species might be referred to the genus *Pterolepis,* which is composed of insects larger than most species of *Rhacocleis* and differing from them in a single character, namely the presence of an inner pair of terminal spurs of the hind tibia. The importance of this character appears somewhat uncertain, although it is used to separate not only genera of Decticinae, but even larger groups. The female type of *R. graeca* has one of the hind tibiae without the inner spurs, as should be expected in a

Rhacocleis, but on the other tibia there is a single, somewhat underdeveloped, inner spur; all males have no inner spurs. Thus, on formal grounds, the new species is referred to *Rhacocleis,* but the relation of this genus to *Pterolepis* requires a thorough reconsideration.

A noteworthy feature of the new species is its abdominal specialization. The subgenital plate is, however, less unusual than one would think from the current descriptions of the plate in *R. germanica.* All authors say that in the latter species the subgenital plate is simply triangular, but they all overlooked the fact that it is quite abnormally developed and consists of two parts, incompletely separated by a transverse fold (Fig. 14). It is only the apical part that is triangular, while the basal is almost semicircular, concave and bears a pair of ridges forming a lyre-shaped structure and converging to a point at the base hidden under the edge of the seventh sternite. That sternite and the sixth are quite normal in *R. germanica,* while in the new species the sixth is reduced and the seventh missing. A further point of resemblance between *R. graeca* and *R. germanica* is in the structure of the male cercus, but they are abundantly different in this respect, as well as in the shape of the last tergite of the male (compare figs. 12 & 13 and 15 & 16).

Pterolepis gessardi Bonnet

1886. *Pterolepis gessardi* Bonnet, Le Naturaliste, ann. 8, p. 245.

1893. *Pterolepis indigena* Finot, Ann. Soc. ent. France, LXV, p. 520, (Syn. nov.).

A careful comparison of the specimens before me with the descriptions by Bonnet and by Finot revealed that they agree with both. This suggested that the two species are synonymous, a view already put forward in a tentative way by I. Bolívar [29] and fully confirmed by Dr. L. Chopard who has, at my request, examined the types of Bonnet and of Finot. It is certainly strange that Finot, in his comprehensive work on Algerian and Tunisian Orthoptera, has ignored Bonnet's species.

Our specimens are from Kouba near Algiers; Tablat; Boghari and the Aurés mountains, all in Algeria.

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[29] Bol. R. Soc. Esp. Hist. Nat., 1905, p. 46.

Pholidoptera lyra new species (Pl. XXV, figs. 17, 18, 19, 20, 21)

Very similar and closely allied to *Ph. chabrieri* (Charpentier, 1825), but clearly different from it in the following characters:

Type.—♂; Nazareth, Palestine. June 15, 1921. (P. A. Buxton.) [British Museum (Natural History).]

♂ (*type*). Last tergite (Fig. 17) with large, divergent and strongly excurved appendages, separated by a narrow oval excision. Cercus conical, weakly excurved; its hook swollen, with attenuated apex (compare figs. 19 and 22). Subgenital plate (Fig. 18) with a deep, narrowly heart-shaped excision, the inner posterior angles of which are distinctly attenuated; two spinules at the base of the style, the inner spinule being much shorter than the outer (compare figs. 20 and 23).

♀ (*paratype*). Subgenital plate (Fig. 21) widest in the basal third, beyond this with straight margins; apical excision large, rectangular; lobes a little less than 90°.

Measurements.—Length of body, ♂ 23, ♀ 24; pronotum, ♂ 10, ♀ 9.5; hind femur, ♂ 23, ♀ 25; ovipositor, ♀ 27 mm.

Specimens examined.—PALESTINE: Nazareth, VI, 30, 1921, 1 ♀; VI, 15, 1931, 1 ♂ (*type*), 3 ♀ (P. A. Buxton).

Pholidoptera palaestinensis Ramme

1939. *Pholidoptera palaestinensis* Ramme, Mitt. Zool. Mus. Berlin, xxiv, p. 99.

1939. *Pholidoptera ledereri hebraea* Uvarov, Ann. & Mag. nat. Hist., (11), iv, p. 223, (Syn. nov.).

My description of *hebraea* appeared on August 1st, while that of *palaestinensis* Ramme was published on July 1st, 1939, and the latter name has priority. The type of *palaestinensis,* according to its description, has two small spinules at the base of the male style, while there is definitely only one in *hebraea;* but the spinules being small, this appears an individual variation and I do not hesitate in establishing the above synonymy, the more so that both insects were described from Tiberias.

It appears probable that the present species replaces *Ph. chabrieri* in Palestine.

Conocephalus hastatus (Charpentier) (Pl. XXVI, figs. 25, 26, 27)

1825. *Locusta hastata* Charpentier, Horae Entom., p. 113.

1853. *Xyphidium hastatum* Fieber, Lotos, iii, p. 170.

1854. *Xyphidium hastatum* Fieber, Lotos, iv, p. 223.

1868. *Xiphidium hastatum* Frivaldszky, Ertek. Tudom. Akad., I, (12), p. 110, pl. IV, fig. 3.
1889. *Xiphidium hastatum* Brunner von Wattenwyl, Prodr. Eur. Orth., p. 304, fig. 70.
1883. *Xyphidium hastatum* Pančić, Glasnik Srpskog. Uch. Drush., XV, p. 113.
1891. *Xiphidium hastatum* Redtenbacher, Verh. Zool-bot. Ges. Wien, XLI, p. 205, fig. 89.

Our present knowledge of this species is far from satisfactory. Charpentier (1825) described it very briefly from the female sex alone, and characterized it mainly by the exceptional length of the ovipositor. The type was from Hungary and was preserved in the Berlin Museum. Fieber in 1853 has merely quoted Charpentier, but in 1854 gave a brief diagnosis of both sexes, describing the male cercus as provided with a tooth-like projection beyond the middle, and with the apical spine being oblique, hooked inwards. Frivaldszky (1868) gave a profile figure of the female, but did not add any essential characters. Brunner (1882) also figured the female and described the male cercus as conical, granulose and pilose, terminating in a smooth incurved spine, without a basal tooth. Pančić (1883), on the other hand, stated that the male cercus is rather thick at the base, curved apically, and provided with a tooth near the middle, while Redtenbacher (1891) described the cercus as conical, not dentate internally and ending in an incurved spine; the figure of the male abdomen provided by Redtenbacher is of little value except that it shows the general shape of the cercus. This diversity of descriptions of the male cercus by different authors may be partly due to insufficient observation and inexact expressions, but such explanation is certainly inadequate in the case of Fieber's and Pančić's statements that the cercus is provided with a tooth about the middle of the inner margin, contrary to Brunner's and Redtenbacher's descriptions. This suggests that possibly more than one species was involved, but we have no means of establishing which of them was the true *hastatus* of Charpentier, which was based on a female, unless the original specimens of Charpentier and Fieber can be re-examined, if they still exist.

I have before me a small series of specimens from Rakovitza near Belgrade which agree in the female sex with all descriptions of *hastatus*. The male is characterised by the cercus (Fig. 26) of a shape very similar to that figured by Redtenbacher, particularly as regards the roundly obtusangular bend of the external margin; its basal half, however, is provided with a lobe-like expansion of the inner upper margin, while close to the base there is a strong decurved tooth. This tooth is invisible unless the cercus is dissected out, or at least strongly bent outwards, and was probably overlooked by Brunner and Redtenbacher; if this is admitted, there are strong reasons to believe that my insect is the same as the one described by them. The last tergite of the male in my specimens is as figured (Fig. 27), and agrees with Brunner's description of its posterior margin as produced in two teeth, as well as with Redtenbacher's figure, which, however, shows a deep emargination between the two lobes, probably due to shrivelling.

Conocephalus grebenchikovi new species (Pl. XXVI, figs. 28, 29, 30)

Very similar to *C. hastatus* (Charpentier, 1825), as characterised above, but differing in the structure of the male cercus, last abdominal tergite, the length and shape of elytron (compare figs. 25 and 28) and the unarmed prosternum.

Type.—♂; Kalavryta, Mt. Chelmos, Peloponnesus, Greece. 700 m. July 31, 1938, "in paludosis." (O. Grebenchikoff.) [British Museum (Natural History).]

♂. Fastigium of vertex, viewed from the front, widened upwards, its upper width being about twice the lower. Lateral pronotal lobe considerably longer than deep; surface uneven, with a distinct oblong callous convexity near the posterior margin. Prosternum without spines. Anterior tibia below with 6 spines on each side. Posterior femur unarmed below; each knee-lobe with a single spine. Elytra longer than pronotum, distinctly longer than broad, with the apical angle acute, the tip parabolic (Fig. 28). Last tergite (Fig. 30) attenuated behind; its apex divided in two narrow rounded lobes, separated by a shallow round excision. Cercus (Fig. 29) with the basal part flask-shaped, bent behind the middle under an obtuse angle; the apical part relatively broad, incurved, ending in a blunt hook; the basal part above bears a long narrow inner lobe provided basally with a flat broad, strongly decurved tooth, (the body of the cercus is shown in the fig. 29, by dotted line). Subgenital plate in the type deformed, but appears to be provided with a deep emargination between the style.

Measurement.—Length of body 16; pronotum, 3.5; elytra, 4; hind femur, 11 mm.

Known only from the unique type.

Steropleurus idomenaei (Lucas, 1854) (Pl. XXVI, fig. 31)

This species, known to me by specimens from Samaria, Omalos, Crete, VII, 31, 1939 (O. Grebenchikoff), has been synonymized by Ramme[80] with the Sicilian *S. siculus* (Fieber, 1853). A comparison of the male cerci, however, shows a considerable difference between the two species (see figs. 31 and 32), and I am, therefore, restoring *S. idomenaei* (Lucas) as a good species, endemic to Crete.

ACRIDIDAE

The Genus Stenobothrus Fischer in North Africa

Two North African species of *Stenobothrus* were recognised by me in 1937,[81] but on studying additional material, as well as re-examining the old, I am now able to distinguish four very clearly defined species, as follows:

Stenobothrus amaenus (Brisout) (Pl. XXVI, figs. 46, 47, 48)

1850. *Acridium amaenum* Brisout, Bull. Soc. Ent. France, (2), VIII, p. 426.
1895. *Stenobothrus amaenus* Finot, Ann. Soc. Ent. France, LXIV, p. 426.
1910. *Omocestus amoenus* Kirby, Syn. Cat. Orth., III, p. 172.
1927. *Stenobothrus amoenus* Uvarov, Bull. Soc. Sci. Nat. Maroc., VII, p. 205.

This species is known to me by two male and two female syntypes in the British Museum collection, all from Aumale in Algeria, and originally from the Brisout collection. One pair came to the Museum through Westwood, while the other pair (as well as a male and two females now in the Oxford Museum) were received from A. de Bormans by Dr. Malcolm Burr.[82] The British Museum male from the last named lot is here selected as the single type of the species.

Since this typical material is in a very poor state of preservation, in 1937, I mistakenly identified as *S. amaenus* a series of specimens from the Moroccan Atlas (see below, under *S. maroccanus* (sp. n.), but a study of fresh material from Algeria led me to revise the whole question, and enabled me to offer a re-description of the true *S. amaenus* Brisout (see below, in the key to species).

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[80] Eos, III, 1927, p. 188.
[81] Ann. Mag. Nat. Hist., (10), XIX, p. 308, 1937.
[82] See Uvarov, Eos, XI, 1935, p. 90.

The Spanish *S. festivus* I. Bolívar, 1877, according to its author,[83] may be a synonym of *S. amaenus*, but the Spanish material at my disposal is inadequate to reach a decision.

Stenobothrus amaenus is known only from Algeria; Aumale (Brisout); Constantine, Boghari, Teniet (Finot, 1895); El Gherra station, south of Constantine, VII, 2–4, 1939 (M. Korsakoff). Werner's record from Djurdjura[84] refers, at least partly, to *S. berberus* sp. n. (see below).

Stenobothrus maroccanus new species (Pl. XXVI, figs. 38, 39, 40)

1932. *Stenobothrus palpalis* (partim) Werner, Sitzber. Akad. Wiss. Wien, Mat.-nat. Kl., CXLI, (abt. 1), p. 136, fig. 5, (nec Uvarov).

1937. *Stenobothrus amoenus* Uvarov, Ann. Mag. Nat. Hist., (10), XIX, p. 310 (nec Brisout).

1938. *Stenobothrus amoenus* Chapman, Proc. R. Ent. Soc. London, (B), VII, p. 98, (nec Brisout).

I have studied some of the material recorded by Werner and found it to consist of *S. palpalis* Uvarov and the present species, which I have previously misidentified as *S. amaenus*. Werner's photograph[85] clearly represents *S. maroccanus*, as shown by the venation and the short antenna.

Type.—♂; Azrou, Middle Atlas, Morocco. 4400 feet. June, 1936. [British Museum (Natural History).]

This species, described below (in the key), is known to me from the following material:

MOROCCO, Middle Atlas; Azrou, 4400 ft., VI, 1936, 3♂, (including the *type*), 2♀. Timhadit, 5000 ft., VI, 1936, 3♂, 2♀. Aguelman Sidi Ali ou Mohammed, 6500 ft., VI, 1936, 4♂, 3♀, (Chapman and Bisset). Azrou, V. 31, 1930, 1♂, 1♀ (F. Werner).

Stenobothrus palpalis Uvarov (Pl. XXVI, figs. 33, 34, 35, 36, 37)

1927. *Stenobothrus palpalis* Uvarov, Bull. Soc. Sci. Nat. Maroc, VII, p. 203, fig. 1.

1932. *Stenobothrus palpalis* (partim) Werner, Sitzber. Akad. Wiss. Wien, Mat.-nat. Kl., CXLI, (abt. 1), p. 136, (nec fig. 5).

1937. *Stenobothrus palpalis* Uvarov, Ann. Mag. Nat. Hist., (10), XIX, p. 310, figs. M, and F.

1938. *Stenobothrus palpalis* Chapman, Proc. R. Ent. Soc. London, (B), VII, p. 98.

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[83] Ann. Sci. Nat. Porto, IV, p. 228, 1897.

[84] Sitzber. Akad. Wiss. Wien, Mat.-nat. Kl., CXXIII, p. 392, 1914.

[85] Sitzber. Akad. Wiss. Wien, Mat.-nat. Kl., CXLI, (abt. 1), p. 136, fig. 5.

As already reported by me (1937), Werner's material from Morocco contained a mixture of this species with *S. maroccanus*. Both species were collected together in a number of localities in the Middle Atlas of Morocco by Chapman and Bisset,[86] but *S. palpalis* was also taken at Tizi N'Test, 7150 feet, in the Great Atlas of Morocco.

Stenobothrus berberus new species (Pl. XXVI, figs. 41, 42, 43, 44, 45)

1914. *Stenobothrus amoenus* Werner, Sitzber. Akad. Wiss. Wien, Mat.-nat. Kl., CXXIII, (abt. 1), p. 392, (nec Brisout).

1032. *Stenobothrus palpalis* (partim) Werner, Sitzber. Akad. Wiss. Wien, Mat.-nat. Kl., CXLI, (abt. 1), p. 136, (nec Uvarov).

Type.—♂; Djurdjura Mountains, Algeria, 1700–2000 meters. July 16, 1910. [British Museum (Natural History).]

The specimen was part of the series recorded by Werner (1914) as *S. amoenus* and later (1932) as *S. palpalis*, but the species is abundantly distinct from both, as will be seen from the key below.

Key to Males of North African Species of Stenobothrus

1(4). Maxillary and labial palpi ordinary. Radial veins of elytra practically straight; discoidal area with irregular, not incrassate, cross-veins; interulnar area about half the width of the discoidal. Last tergite without a furcula. Supra-anal plate with very weak depressions or without them.

2(3). Relatively slender, with relatively long head and distinctly constricted pronotum. Fastigium of vertex parabolic. Eyes long. Lateral pronotal carinae angularly incurved in prozona, with both sections quite straight, and reaching the hind margin of pronotum; hind angle of pronotum very obtuse, incised (Fig. 46). Elytron relatively short and narrow; costal area fairly broad, with very sparse venation; scapular area broad throughout, with sparse venation; radial veins quite straight; interradial area moderately expanded near apex (Fig. 47). Last tergite with broad parabolic excision; lateral margins of the excision weakly sinuate near the insertions of the cerci. Supra-anal plate rounded-triangular, with short attenuated apical portions; surface very weakly impressed along the middle, and on the sides of the apical half, which is separated from the basal half by very weakly raised transverse convexities (Fig. 48).—Algerian Atlas..*amaenus* (Brisout)

3(2). Robust, with short thick head and scarcely constricted pronotum. Fastigium of vertex rectangular, the apex acute. Eyes short. Lateral pronotal carinae roundly incurved in prozona, with both sections weakly excurved, and not reaching the hind margin of pronotum; hind angle of pronotum obtuse, its apex not rounded (Fig. 38).

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[86] See Chapman, Proc. R. Ent. Soc. London, (B), VII, p. 98, 1938.

Elytron relatively short and broad; costal area narrow and long; scapular area narrow; radial veins slightly sinuate, interradial area narrow (Fig. 39). Last tergite with a broad trapezoidal excision; margins of the excision distinctly sinuate about half-way between the median line and the insertion of cerci. Supra-anal plate rounded-triangular; apical portion not attenuate; surface with only faint broad longitudinal impression in the basal portion (Fig. 40).—Moroccan Middle Atlas.............................*maroccanus* new species

4(1). Maxillary and labial palpi with the terminal joints expanded and partly black. Radial veins of elytra distinctly sinuate; discoidal area broad, with regular, more or less incrassate, cross-veins; interulnar area very narrow. Last tergite with a furcula. Supra-anal plate with four depressions separated by a longitudinal and a transverse ridge.

5(6). Relatively slender, with long head and distinctly constricted pronotum (Fig. 41). Fastigium of vertex parabolic with acute apical angle and curved margins. Lateral pronotal carinae weakly incurved in prozona, straight in metazona, reaching the hind margin. Elytron long and narrow (Fig. 42); scapular area narrower than the interradial; discoidal area less expanded. Last tergite (Fig. 43) with an irregularly parabolic excision, margins of which are sinuate. Supra-anal plate semi-oval. Subgenital plate, viewed ventrally, distinctly constricted near apex.—Djurdjura Mts., Algeria.
berberus new species

6(5). Relatively stout, with short head and scarcely constricted pronotum (Fig. 33). Antennae very long, distinctly clavate apically. Fastigium of vertex angular, with straight margins. Lateral pronotal carinae strongly incurved in prozona; the posterior portion distinctly excurved; not reaching hind margin. Elytron (Fig. 34) broad; scapular area broader than the interradial; discoidal area strongly expanded. Emargination of the last tergite trapezoidal with straight margins (Fig. 35). Subgenital plate, viewed ventrally (Fig. 36) gradually narrowing to truncate apex.—Moroccan Middle and Great Atlas...*palpalis* Uvarov

Omocestus minutus (Brullé)

1832. *Oedipoda minuta* Brullé, Expl. Sci. Morée, Ins., p. 94, pl. 30, fig. 5.
1926. *Omocestus moreanus* Ramme, Deutsch. Ent. Ztschr., 1926, p. 274, pl. 2, fig. 2, (Syn. nov.).
1927. *Omocestus chersonensis* Pustovoit, Defense des Plantes: Leningrad, IV, p. 956.
1928. *Omocestus minutus* Znoiko, Rev. Russe Entom., XXII, p. 192, fig. 4, pl. 2, figs. a, b.

Znoiko in 1928 has clarified the taxonomic position of *Oedipoda minuta* (Brullé), and provided its redescription, including the male internal genitalia. I am now able to add *Omocestus moreanus* Ramme as a synonym, its description leaving no doubt that it applies to this very common species of Greece and the Southern Balkans. It is known to me from Thessaly (Mt. Olympus, Litochoron, 0–200 m.); Macedonia (near Salonika; recorded by me as *O. petraeus* Bris.,[87] Kambos in Taygetos (Ramme's record); Kozuh Mts., Gevgeli, S. Serbia; it should occur also in Bulgaria and Rumania, since it is found near Odessa and on the lower Dnieper, as well as near Poltava (Znoiko and Pustovoit, as above).

Dociostaurus curvicercus new species (Pl. XXVI, fig. 49)

Similar to *D. genei* (Ocskay, 1832), but larger, with the head less projecting upwards, and differing from all species of the genus by the strongly incurved male cerci.

Type.—♂; Rehoboth, near Jaffa, Palestine. (J. Aharoni.) [British Museum (Natural History).]

♂ (*type*). Antennae slender, a little longer than head and pronotum together.

Head somewhat projecting upwards. Face strongly oblique. Frontal ridge shallowly sulcate throughout, at the fastigium rather suddenly narrowed, becoming almost linear at the upper half of the foveolae; viewed in profile, it is regularly and weakly convex. Foveolae well defined, large, scarcely longer than wide, weakly narrowed forward (their shape and position as in *D. genei*). Fastigium of vertex elongate pentagonal, concave, with well raised margins. Occiput without median carina.

Pronotum relatively longer than in *D. genei.* Typical transverse sulcus in the middle. Hind margin decidedly more produced than in *D. genei.* Median carina low, acute. Lateral carinae in the prozona replaced by light stripes, which are less divergent forwards than in *D. genei;* carinae in the metazona are well developed, enclosed in pale stripes, and less divergent backwards than in *D. genei;* the length of the lateral margin of metazona is approximately equal to the length of one side of the hind margin (in *D. genei* distinctly longer relatively). Elytra long and narrow, extending well beyond hind knees. Pulvillus between tarsal claws equal to half the length of a claw.

Last tergite with a pair of small, widely distant appendages (in *D. genei* the appendages are very broad and very narrowly separate; compare figs. 49 and 50). Supra-anal plate rounded-pentagonal, with a separate triangular apical projection and rounded shoulders. Cercus thick, strongly incurved. Subgenital plate large, hairy, somewhat compressed dorso-ventrally, with the apex rounded-truncate.

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[87] Trans. Ent. Soc. London, 1923, p. 159.

Colouration and pattern as in *D. genei.* Hind tibia bluish-testaceous, with a broad pale basal portion.

♀ (*paratype*). Differs from that of *D. genei* by larger size, and relatively longer pronotum, with the lateral carinae less divergent both forwards and backwards.

Measurements.—Length of body, ♂ 15, ♀ 18; pronotum, ♂ 3.2, ♀ 4; elytra, ♂ 15, ♀ 18; hind femur, ♂ 10, ♀ 13 m.m.

Specimens examined.—PALESTINE: Rehoboth near Jaffa, (J. Aharoni), 1 ♂ (type), 1 ♀. Jerusalem near Samivel, VI, 4, 1921, 2 ♂, 1 ♀. Akka, VI, 10, 1921, 1 ♀; VI, 29, 1921, 1 ♀. Mt. Carmel, 800 ft., VI, 27–30, 1931, 6 ♂. Haifa, VI, 25, 1921, 2 ♀; VII, 14, 1921, 1 ♂. Khedira, coastal zone, V, 31, 1921, 1 ♂, 1 ♀. Nazareth, 1200 ft., VI, 30, 1921, 2 ♂, 1 ♀, (all P. A. Buxton); XI, 14, 1935, 2 ♂, 2 ♀. Jerusalem, XI, 7–12, 1935, 1 ♀, (G. M. Henry).

A re-examination of the Palestine series of supposed *D. genei* proved it to include specimens of another species, superficially similar, but differing strikingly in the structure of the male genitalia. The true *D. genei* is before me now only from Jericho, Tel Arad, Zorah and Wadi Kelt, and they represent the small pale coloured form which Bodenheimer[88] supposed to represent a subspecies distinct from the rest. It would appear that *D. genei* is found in Palestine only in isolated colonies, while *D. curvicercus* is distributed more widely, although a true picture of the distribution of both species would be obtained only by the examination of abundant material from all parts of the country.

The shape of the male cercus in the new species is unique in the genus, though a tendency to a curvature is observed in *D. maroccanus* (Thunberg, 1815), which the new species approaches also in the structure of the subgenital plate.

XEROHIPPUS new genus

My colleague, Mr. S. P. Tarbinsky, asked me some years ago for material of the Palestinian insect then determined by me as *Stenobothrus syriacus* I. Bolívar, and referred to the genus *Eremippus* Uvarov, which he had the intention of revising. His conclusion, on examining the specimens, was that they represent a distinct subgenus of *Eremippus,* to which he referred also *Stenobothrus azami* I. Bolívar and an undescribed Palestinian species. As Mr. Tarbinsky has been unable to undertake the intended revision, he has returned the material to me, kindly placing at my disposal his observations on the species involved. In the meantime, there has accumulated in my hands considerable fresh material of the same and allied species, from Palestine and Cyprus, which I regard as constituting a group sufficiently well defined to be regarded as a new genus, with the following characters:

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[88] Arch. f. Naturgesch., (n.f.) IV, p. 181, 1935.

Allied to *Eremippus* Uvarov, 1926, differing from it by the well developed tarsal arolia, by distinctly ensiform antennae in both sexes, and by the lower valvae of the ovipositor being without a basal tooth or projection, which is always present and is usually strongly developed in species of *Eremippus.* Foveolae of vertex in *Xerohippus* are on an oblique plane and therefore partly visible from above; this, however, is not a character distinguishing the new genus from *Eremippus* since the position of the foveolae in the latter varies from vertical to oblique. Frontal ridge in *Xerohippus* is less deeply sulcate than in *Eremippus,* but this is also a character of uncertain generic value.

On the whole, *Xerohippus* represents a less pronounced specialization of the normal characters of the group Chorthippi than is found in *Eremippus.* It differs from *Chorthippus* and its allies by the ensiform antennae, by the swelling on the prosternum and by the development, especially in the female sex, of false veins in the discoidal and the inter-ulnar areas of the elytra; the discoidal vein, however, is very irregular and has no stridulatory function, as is the case in *Aiolopus* (see p. 336).

The new genus includes four previously known and three new species. One of the latter, *Xerohippus cyprius* n. sp., is selected as the type, since it is impossible to be quite certain in the determination of the species previously described.

Since the species differ from each other in few characters, a full description will be given only of the genotype, and comparative notes on others, together with illustrations (Figs. 51 to 82) and the key on p. 333, should be sufficient for taxonomic purposes.

Xerohippus cyprius new species (Pl. XXVII, figs. 57, 58, 59, 60, 61, 62)

Type.—♀; Limassol, Cyprus. May 19, 1925. [British Museum (Natural History).]

♀ (*type*). Antennae distinctly ensiform, somewhat longer than head and pronotum together; joint 3 distinctly longer than its maximum width; 4 transverse; 5 elongate; 6 transverse; 7 and the following elongate.

Face in profile forming with the fastigium an acute angle with rounded apex. Frontal ridge practically parallel-sided between fastigium and the ocellus, weakly expanding below the latter; its surface concave downwards from half-way between fastigium and ocellus. Fastigium of vertex scarcely concave, weakly transverse. Foveola of vertex more than twice as long as its greatest width, narrowed forwards, with weakly curved and not strongly raised margins; surface shallowly concave.

Pronotum weakly constricted, broadly rounded-angulate behind. Median carina well raised, more acute in metazona, which is only a little shorter than prozona. Lateral carinae weakly roundly inflexed in prozona, being most closely approximated in its apical third, and very weakly excurved and divergent in metazona. Lateral lobe longer than deep, with the lower anterior angle very obtuse and the lower margin obliquely ascending in its anterior part.

Prosternum with a low transverse swelling. Mesosternal lobe a little wider than long, with the interspace as wide as a lobe, but widened posteriorly. Metasternal interspace about as wide as long.

Elytra extending a little beyond the hind knee. Costal area reaching beyond the middle of the costal margin, with a weak post-basal expansion. Scapular area distinctly expanded, with fairly regular oblique veinlets. First and second radial veins weakly sinuate; the area between them weakly expanded, with widely spaced veinlets. Third radial vein weak and not very regular, beyond the basal quarter gradually diverging from the second. Discoidal area wide, with two rows of fairly large cells, separated by an irregular false vein. Interulnar area about as broad as the discoidal, with a very irregular false vein.

Supraanal plate tongue-shaped, convex. Cercus short, bluntly conical. Paraprocts large, covering up the basal parts of the upper ovipositor valves. The upper valve very stout, with short recurved apex; upper surface tuberculate near the base. Lowere valve short, stout; its apical part viewed ventrally is as long as its basal width, with the apex obtuse; its basal part is convex and coarsely tuberculate.

General colouration brownish-buff, practically without any pattern, except darker shading on the pronotal metazona inwards from the lateral carinae which are pale.

♂ (*paratype*). Antennae much longer than head and pronotum together, in the basal portion flattened, but scarcely expanded. Joint 3 longer than its maximum width; 4 distinctly elongate; 5 transverse; the following ones elongate. Frontal ridge sulcate throughout, with the margins well raised and the surface coarsely punctured. Fastigium of vertex rhomboidal, longer than wide, with decidedly acute apex. Mesosternal interspace narrower than one of the lobes; metasternal interspace linear.

Elytra reaching well beyond hind knees. Costal area not quite reaching the middle of the costal margin, with a weak postbasal projection. Scapular area well expanded, with regular oblique veinlets. First radial vein practically straight except near the apex where it curves back; second radial weakly bi-sinuate, separated from the first by a well expanded area with regularly spaced veinlets. Discoidal area wide, with a double row of cells and an imperfect false vein. Interulnar area narrower than the discoidal, with a single row of cells and no false vein.

Last tergite obtusely excised; each side with a short, but broad, rounded lobe, placed about one third of the distance from the middle line. Supra-anal plate tongue-shaped, a little longer than its basal width, with a short apical ligula; surface with a broad median furrow. Cercus cylindrical, weakly narrowed to the rounded apex, decidedly longer than the supraanal plate. Subgenital plate obtusely conical, somewhat compressed laterally.

Measurements.—See table on p. 332.

Specimens examined: CYPRUS: Limassol, IV, 29, 1925, 3♂; V, 2, 1925, 2♂, 1♀; V, 13, 1925, 1♂, 1♀; V, 19, 1925, 1♂, 6♀ (including the type); V, 20, 1925, 1♂; V, 25, 1925, 1♀; IX, 29, 1925, 1♂. Limassol Bay, VIII, 2, 1925, 1♀.

The series is rather uniform in colouration, though some specimens are of a paler shade than others, while one female (V, 13, 1925) is somewhat blackened above, mainly on the elytra.

Xerohippus savignyi (Krauss) (Pl. XXVII, figs. 51, 52, 53, 54, 55, 56)

1825. (No name.) Savigny, Descr. de l'Egypte, x, pl. 6, fig. 9, 1.
1890. *Duronia Savignyi* Krauss, Verh. zool.-bot. Ges. Wien, XL, p. 259.
1924. *Stauroderus savignyi* Buxton & Uvarov, Bull. Soc. R. Ent. Egypte, 1923, p. 185, (partim).
1935. *Eremippus savignyi* Bodenheimer, Arch. Naturgesch., (n.f.), IV, p. 184, (partim).

Krauss (1890) has based the name *Duronia savignyi* on the figure of a female from unknown locality in Savigny's work, and that figure should be regarded as the type of the species. At the same time, he has referred to it a female from Jerusalem, which he later[39] considered a distinct species, *Duronia laticornis* Krauss, 1909, while he relegated *D. savignyi* to the synonymy of *D. lucasi* I. Bolívar, 1881. There is no doubt, however, that Savigny's figure does not represent a *Duroniella* (to which genus *D. laticornis* and *D. lucasi* are now referred), but a member of the present genus *Xerohippus*, since the lateral pronotal carinae are shown to have a very characteristic shape, quite unlike that in *Duroniella*. This induced me[40] to regard the insect figured by Savigny as conspecific with *Stauroderus syriacus* I. Bolívar, 1911, but the present revision shows that this determination was not justified

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[39] Verh. Naturwiss. Ver. Karlsruhe, XXI, p. 41, 1909.
[40] See Buxton & Uvarov, Bull. Soc. R. Ent. Egypte, 1923, p. 185, 1924.

(see p. 332), and that *syriacus,* although not known to me by specimens, is probably well distinct from the two Palestinian species (*savignyi* and *palaestinus,* see below) known at present. The figure by Savigny is insufficiently exact to be definitely referred to one of these two species, but it agrees better in the size and the shape of head with the larger one, and I feel justified in adopting for it the name *savignyi* Krauss. The alternative to this somewhat arbitrary action would be to regard both Palestinian species as new and to retain the name *savignyi* as belonging to a species which is not only indeterminable at present, but which has little chance to be determined in future with any certainty.

X. savignyi is very similar in size and general appearance to *X. cyprius,* the main specific characters being as follows:

♀. Antennae strongly ensiform; joints 3 to 6 similar in shape to those in *X. cyprius;* 7 and 8 transverse; 9 and the following moderately elongate.

Face in profile forming with the fastigium a very acute angle, the apex of which is rounded; the upper part of the frontal ridge, viewed in profile, somewhat projecting forward. Foveola of vertex relatively broad, with distinctly curved margins.

Metazona of pronotum distinctly shorter than prozona. Lateral carinae in prozona bi-sinuate, in metazona weakly divergent. Ovipositor short, stout, with the apical part of the lower valve, viewed ventrally, as long as broad, with blunt apex.

Colouration varying from pale-buff to chocolate brown; lateral pronotal carinae often paler, enclosed in dark stripes.

♂. Antennae weakly, but distinctly, expanded in the basal part; joint 3 and the following elongate. Fastigium of vertex elongate-rhomboidal, with very acute apex.

Measurements.—See table on p. 332.

Specimens examined.—Palestine: Nazareth, V, 22, 1922, 1♂, 4♀. Jerusalem, V, 26, 1922, 2♀. 16 miles south of Nablus, VI, 1, 1921, 1♀. Tul Karem, VI, 20, 1922, 1♀. Kalan Sawa, Tul Karem, VI, 14, 1922, 1♀. Athlit, coastal zone, VI, 2, 1921, 1♀ (P. A. Buxton). Rehoboth, Nr. Jaffa, 1♂ (J. Aharoni). Emek, V, 19, 1926 (F. Bodenheimer).

Xerohippus azami (I. Bolívar) (Pl. XXVII, figs. 69, 70, 71, 72)

1901. *Stenobothrus azami* I. Bolívar, Bull. Soc. ent. France, 1901, p. 189.

As I am unable at present to examine the type of *Stenobothrus azami,* it is impossible to be quite certain of the determination of the insect which I am referring to this species. It appears reasonable, however, to apply the name *azami* to that one of the three

Cyprian species which best agrees with the description of *asami*, rather than leave *asami* in suspension as an imperfectly known species.

♀. Smaller than *X. cyprius*. Antennae somewhat longer than head and pronotum, distinctly ensiform; joint 3 a little longer than its maximum width, subdivided in two; 4 and 5 transverse; 6 elongate, subdivided; 7 weakly transverse; 8 almost square; the following elongate. Fastigium of vertex smaller than in *X. cyprius*, rounded-pentagonal, scarcely broader than long. Foveola of vertex little more than twice as long as its maximum width, with the margins curved. Prozona of the pronotum distinctly longer than metazona; lateral carinae in prozona strongly bi-sinuate; posterior margin more broadly rounded than in *X. cyprius*.

Ovipositor valves slender, pointed; apical part of the lower valve in ventral aspect, distinctly longer than its basal width, strongly tapering to an acute apex.

Colouration pale-buff; lateral pronotal carinae lighter, enclosed in chocolate-brown stripes (in some paratypes these stripes are strongly pronounced, and there is also a dark radial stripe on the elytra enclosing a whitish line; another female paratype is densely mottled with grey on the elytra).

♂. Antennae very long, with all joints strongly elongate. Fastigium of vertex narrowly-parabolic, considerably longer than wide.

Measurements.—See table on p. 332.

Specimens examined: Cyprus: Akrotiri peninsula, Asomatos, IX, 12–19, 1935, 9 ♂, 6 ♀, (G. Mavromoustakis).

Xerohippus palaestinus new species

(Pl. XXVII, figs. 63, 64, 65, 66, 67, 68)

Type.—♀; Nazareth, Palestine. November 14, 1935. (G. M. Henry.) [British Museum (Natural History).]

♀ (*type*). Smaller and more slender than *X. savignyi*.

Antennae a little longer than head and pronotum, narrowly ensiform. Joint 3 scarcely longer than its maximum width; 4 to 8 transverse; the following moderately elongate.

Fastigium of vertex small, broadly rounded, transverse. Foveolae of vertex three times as long as its maximum width, little narrowed forwards, margins broadly curved.

Prozona of pronotum distinctly longer than metazona; lateral carinae on the prozona weakly inflexed (in some paratype the inflexion is very weak and broad).

Ovipositor valves long, pointed; viewed ventrally, the apical part of the lower valve is much longer than its basal width, strongly tapering to acute apex.

General colouration brownish-testaceous, mottled with grey and dark brown; lateral pronotal carinae very pale, enclosed in dark chocolate-brown stripes. Hind femur with traces of dark fasciae.

♂ (*paratype*). Antennae with joint 4 square, the following elongate. Fastigium of vertex elongate-oval, with the apex rounded. Lateral pronotal carinae very weakly and broadly inflexed.

Measurements.—See table on p. 332.

Specimens examined: PALESTINE: Jerusalem, IX, 22, 1922, 2♀; X, 10, 1922, 1♂, 1♀, (P. A. Buxton); 3♂, 2♀, (F. Bodenheimer). El Hanod, Jesreel valley, 1♀. Ganiger, Jesreel valley, 2♂, 2♀. Undeciphered locality, 1♂, 3♀, (F. Bodenheimer). Nazareth, XI, 14, 1935; 4♀, including the *type*, (G. M. Henry).

Xerohippus solerii (Jannone) (Pl. XXVII, figs. 73, 74, 75, 76)

1936. *Eremippus Solerii* Jannone, Boll. Labor. Zool. Gen. Agr. Portici, XXIX, p. 167, figs.

Only a female paratype of this species is available to me at present. It shows a considerable affinity to *X. azami* as defined above, but differs in the characters shown in the key (p. 333).

X. solerii has been described from the islands of Rhodos and Cos, and the paratype before me is from the latter. It is not impossible that the species from the two islands are distinct.

Xerohippus sinuosus new species

(Pl. XXVII, figs. 77, 78, 79, 80, 81, 82)

This is the smallest known species of the genus, differing from others also in the short rounded head, less elongate eyes and strongly sinuate lateral pronotal carinae.

Type.—♀; Mandria, Pera Pedi Hills, Cyprus. 2500–2800 feet. September 21–28, 1937. (G. Mavromoustakis.) [British Museum (Natural History).]

♀ (*type*). Antennae as long as head and pronotum together. Joint 3 longer than its maximum width; 4 transverse; 5 elongate; 6 transverse; 7 and the following elongate but not strongly so. Face in profile forming a broad arch with the fastigium.

Fastigium small, rounded-pentagonal, a little wider than long. Eyes oval, more rounded than in other species. Foveola narrow, strongly narrowed forwards.

Pronotum with the median carina well raised, particularly in metazona. Lateral carinae thick, callous, in the prozona strongly trisinuate, in metazona distinctly divergent. Typical sulcus well behind the middle. Posterior margin broadly rounded.

Elytra not quite reaching the apex of hind knees.

Ovipositor valves slender, pointed; apical part of the lower valve, viewed ventrally, distinctly longer than its basal width, tapering to an acute apex.

Colouration very pale straw-yellow, with the pronotal lateral carinae surrounded by chocolate-brown. Elytra with the costal area brown veined, and with several faint brownish spots along the anal margin near the apex. Wings with infumate tips.

♂ (*paratype*). Antennae distinctly longer than head and pronotum; joints 4–6 weakly transverse, the rest elongate. Fastigium of vertex elongate-pentagonal, with rounded angles. Colouration mainly buff, mottled and streaked with grey and brown. Wing tips broadly infumate.

Measurements.—See table below.

Specimens examined: Cyprus: Pera Pedi hills, Mandria, 2500–2800 ft., VI, 13, 1937, 1 ♂; IX, 21–28, 1937, 6 ♂, 3 ♀, (G. Mavromoustakis).

Xerohippus syriacus (I. Bolívar)

1911. *Stauroderus syriacus* I. Bolívar, Bull. Soc. Amis Sci. Nat. Rouen, p. 3. (Sep. reprint.)

This species has been described from a single female taken between Homs and the Homs lake, and I thought once[41] that it could be synonymous with *X. savignyi.* The type is probably non-existent, since my efforts to trace the type of another species described in the same paper proved unsuccessful. A careful examination of the original description reveals, however, the following points which probably represent characters of specific value: (1) lateral pronotal carinae are described as "anguleuses dans le prozonite," which cannot be said of any of the known species; (2) lateral pronotal lobes are said to be deeper than long, a condition approached only in *X. sinuosus* which is certainly distinct from *syriacus.* I think, therefore, that it would be best to regard the latter as an independent species until topotypical material can be studied.

Measurements of Xerohippus Species in Millimeters

	Female					Male				
Species	Body	Antenna	Pronotum	Elytra	Hind femur	Body	Antenna	Pronotum	Elytra	Hind femur
X. cyprius	22	8	4.8	16	12	16	9	3.2	13	9.5
X. savignyi	22	7.2	4.8	15	12	15	8	3.1	11	8.5
X. azami	19	7	4	14	12	13	8	2.8	9.5	8
X. palaestinus	19	7	3.8	14	12.5	11	8	2.5	8.5	8
X. solerii	18.4	8	4	13	11.5	13	9	2.5	9.5	8.7
X. syriacus	18	7	4.5	15.5	12.5	—	—	—	—	—
X. sinuosus	18	6.5	3.5	13	10	10.5	6.5	2.2	9	7

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[41] Buxton & Uvarov, Bull. Soc. R. Ent. Egypte, 1923, p. 185, 1924.

Key to Species of Xerohippus

1(12). Lateral pronotal carinae roundly inflexed in prozona.

2(5). Apical part of the lower ovipositor valve, viewed ventrally, is not longer than its basal width (Figs. 55 and 61); all valves short, stout, blunt. Fastigium of vertex larger. Size larger (♀ over 22 mm., ♂ over 15 mm.).

3(4). Typical sulcus almost in the middle of pronotum (Fig. 58). Antennae narrower; joints 7 and 8 in the female distinctly elongate (Fig. 57)..*cyprius*

4(3). Typical sulcus well behind the middle of pronotum (Fig. 52). Antennae wider; joints 7 and 8 transverse (Fig. 51)......*savignyi*

5(2). Apical part of the lower ovipositor valve, viewed ventrally, is distinctly longer than its basal width (Figs. 67, 68, 71, 72, 75, 76, 81, 82); all valves elongate, acute. Size smaller (♀ under 20 mm., ♂ under 13 mm.)

6(11). Antennae distinctly ensiform; in the female joint 6 either transverse or only weakly elongate (Figs. 69, 63).

7(10). Eyes distinctly elongate. Face forming a distinct angle with the fastigium (Fig. 65). Lateral pronotal carinae weakly inflexed in prozona, at most bi-sinuate (Figs. 64, 70).

8(9). Antennae wider, joints 6 and 8 in female transverse, or nearly so (Fig. 63). Lateral pronotal carinae weakly incurved in prozona (Fig. 64)..*palaestinus*

9(8). Antennae narrower; joints 6 and 8 in female elongate (Fig. 69). Lateral pronotal carinae in prozona distinctly bi-sinuate (Fig. 70). *azami*

10(7). Eyes shorter; face forming an arch with the fastigium (Fig. 78). Lateral pronotal carinae strongly tri-sinuate in prozona (Fig. 78). *sinuosus*

11(6). Antennae very weakly ensiform; in female joints 6 and the following strongly elongate (Fig. 73)........................*solerii*

12(1). Lateral pronotal carinae angularly inflexed in prozona......*syriacus*

Arcyptera stenoptera new species (Pl. XXVIII, figs. 85, 86)

A brachypterous species of medium size, differing from all known ones by very strongly constricted X-shaped pattern of pronotum, with the metazonal parts strongly divergent; and by the narrow elytra, not overlapping on the dorsum of the female.

Type.—♀; Above Kalavrita, Mt. Chelmos, Peloponnesus, Greece. 1000 meters. July 27, 1938. (O. Grebenchikoff.) [British Museum (Natural History).]

♀ (*type*). Head large, with swollen cheeks. Frontal ridge flat, broad, distinctly narrowed at the fastigium. Fastigium of vertex strongly transverse, without the median carinula; apical angle very obtuse, not rounded at the tip; foveolae of vertex distinctly concave, quadrangular, more than twice as long as broad.

Pronotum weakly constricted, well widened behind. Front margin weakly convex; hind margin very obtusely angulate. Median carina well raised, sharp. Lateral carinae callous, light-coloured, weakly excurved in the anterior section, strongly convergent to the first sulcus, straight and strongly divergent from the first sulcus to the hind margin.

Elytra almost lateral, well separated from each other on the dorsum, reaching the apex of the third tergite; elongate-oval in shape, strongly narrowed from the middle to the apex which is narrowly parabolic; venation as figured, characterized by the discoidal area being about as broad as the interulnar.

Valvae of the ovipositor very short. Coloration and pattern reminding one rather of a *Dociostaurus* than of an *Arcyptera*. General coloration light ochraceous and stramineous. Pronotal lateral carinae light ivory-yellow, edged by velvety brown. Abdomen with alternating blackish and stramineous oblique lateral stripes. Hind femur with the usual dark pattern developed only on inner upper area; lower side and lower portion of the inner area light reddish; knee with a semilunar spot and less than the basal half of the lobe black. Hind tibia light red, with an incomplete black basal ring. Elytra with a well pronounced callous light ivory-yellow stripe in the scapular area, and some indefinite large brown spots.

Measurements.—Length of body, 30; pronotum, 6; length of elytron, 8.5; maximum width of elytron, 4; hind femur, 15 mm.

The type is unique.

On a casual examination this species might be mistaken for *A. labiata* (Brullé, 1832), but is certainly different from that specifically, as can be seen when the accompanying figures (Figs. 83 to 86) are compared. *A. labiata* is known to me from a long series of specimens from several localities in Greece and in Western Anatolia, and its characters are subject to very little variation. It differs in the female sex from *A. stenoptera* by less inflated head; frontal ridge convex and not constricted at the fastigium, narrower fastigium of vertex; scarcely concave, short and oval foveolae of vertex; pronotum more rounded behind, with the lateral carinae less approximated at the first sulcus and excurved in both sections; while the elytra are of a quite different shape and reach only to the apex of the second tergite.

Amongst other brachypterous species, *A. stenoptera* resembles in the shape of elytra *A. kheili* Azam, 1900, from the Western Alpes

Maritimes,[42] but the pronotum of the latter [43] is very different, with distinctly excurved and weakly divergent sections of the pronotal carinae.

The affinities of *A. stenoptera* cannot be more exactly determined until the male is known, but its independent specific status is beyond doubt.

Arcyptera microptera nigriloba new subspecies

Type.—♂; Mt. Tymphrestos (Veluchi Mts.), Greece. 1000–2300 meters. July, 1938. (O. Grebenchikoff.) [British Museum (Natural History).]

Differs from the typical (South Russian) subspecies by larger size; darker general coloration; less incurved pronotal carinae; and particularly by the external knee-lobes of hind femora being wholly black, with a narrow pale apical margin, in the male, and at least basally black in the female. In this feature, the new subspecies is similar to *A. m. sibirica* Uvarov 1914, which is, however, considerably larger and has strongly incurved pronotal carinae; and to *A. brevipennis* Brunner 1861 of Istria and Dalmatia, which differs in abbreviated elytra and wings, while in the present subspecies they are fully developed, the elytra extending beyond hind knees in the male and reaching their apex in the female.

Measurements.—Length of body, ♂ 23, ♀ 30; pronotum, ♂ 4.5, ♀ 5.5; elytra,. ♂ 20, ♀ 19; hind femur, ♂ 14, ♀ 17 mm.

Specimens examined: GREECE: Mt. Tymphrestos (Veluchi Mts.), 1000–2300 m., VII, 1938, (O. Grebenchikoff), 8 ♂ (including type), 14 ♀. Veluchi Mts., VII, 1932, 2 ♀, [received from Prof. F. Werner].[44] Probably Macedonia, 1 ♀, in Dr. F. Zeuner's collection.

According to Mr. Grebenchikoff, these insects were collected above the town of Karpenission, on stony pastures with shrubs of *Astragalus tymphresteus, Daphne oleoides, Cirsium, Marrubium,* etc., as well as in a lower zone of *Abies* forests.

To this subspecies may probably be referred Brunner's record [45] of a long-winged variety of *A. brevipennis* Br. from Pola, as well as his records of a variety of *A. flavicosta* (=*microptera*) with "black knee-joints" from Liguria, Trieste and Serbia.

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[42] See figure by Capra, Ann. Mus. Civ. Genova, LX, p. 107, fig. 11, 1938.

[43] Ann. Mus. Civ. Genova, LX, fig. 5, 1938.

[44] Recorded by that author as *A. microptera* in Sitzber. Akad. Wiss. Wien. Mat.-nat. Kl., CXLII, (abt. 1), p. 196.

[45] Prodr. Eur. Orth., p. 142.

AIOLOPUS Fieber

Brunner von Wattenwyl in 1882[46] remarked, "Dieses Genus bildet durch die Structur der Deckflügel den Uebergang zu den Oedipodiden, gehört jedoch nach der Form des Kopfes zu den Truxalinen," and all subsequent authors followed that view, relying for the differentiation of Oedipodinae from Acridinae (Truxalinae) on nothing more than the general habitus and particularly the degree of the facial angle. This character, however, is quite unreliable, since many unquestionable Acridine genera have the face vertical, while it is definitely oblique in some Oedipodinae. On the other hand, an excellent subfamily character is provided by the stridulatory mechanism, which in Acridinae (when present) consists of a series of pegs on a special ridge of the hind femur working against the raised second radial vein, while in Oedipodinae the femoral ridge is devoid of pegs and works against a false discoidal vein which is either simply raised, or raised and serrate. Adopting this character for the separation of Oedipodinae from Acridinae, it becomes necessary to transfer *Aiolopus* to the former subfamily, where it enters a natural group composed of *Encoptolophus* Scudder, 1885, *Lerinnia* Uvarov, 1940 (=*Lerina* I. Bolívar, 1902) and *Hilethera* Uvarov, 1925.[47]

The genus *Aiolopus* includes at present about a score of described species, the majority of them being tropical and subtropical in distribution. The bulk of the species belong to a very compact group, specific differences being very small and imperfectly understood. This group includes the formal type of the genus, *Gryllus thalassinus* Fabricius, 1781, as designated by Kirby in 1910,[48] and it is proposed here to restrict the genus *Aiolopus* to this group alone, while two new genera have to be erected to accommodate certain other species differing from *Aiolopus* proper in a number of important characters. The two new genera will be discussed more fully below, but the interrelation of all three may be made clear from the following key:

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[46] Prod. Eur. Orth., p. 145.
[47] See Uvarov, Eos, I, p. 33, 1925.
[48] Syn. Cat. Orth., III, p. 190.

1(4). Discoidal vein of elytra strongly developed, regularly serrulate, approaching in the apical part the posterior radial (Figs. 96, 99). Frontal ridge convex, or flat. Mesosternal interspace in both sexes shorter than broad, widened behind (Figs. 97, 98).

2(3). Discoidal vein sinuate, strongly approaching and almost touching the posterior radial apically (Fig. 96). Male subgenital plate normal, short, obtusely conical. Habitus slender; head normal; face distinctly to strongly oblique. Fastigium of vertex even in the most robust species distinctly elongate. Foveolae of vertex elongate-trapezoidal.—Genotype: *Gryllus thalassinus* Fabricius, 1781........*Aiolopus* Fieber

3(2). Discoidal vein straight, somewhat approaching the posterior radial apically, but well distant from it (Fig. 99). Male subgenital plate compressed dorso-ventrally, long, tongue-shaped (Figs. 100, 101). Habitus very robust; head thick; face almost or quite, vertical. Fastigium of vertex very broad (Fig. 103). Foveolae of vertex elongate-trapezoidal to triangular.—Genotype: *Epacromia platypygia* Pantel, 1886..................................*Platypygius* new genus

4(1). Discoidal vein of elytra weakly developed, irregular, weakly serrulate, running midway between the posterior radial and the anterior ulnar (Fig. 87). Frontal ridge sulcate, especially in the male. Face strongly oblique; fastigium of vertex elongate; foveolae triangular, shallow. Mesosternal interspace longer than wide, distinctly constricted in the middle (Figs. 88, 89). Male subgenital plate compressed dorso-ventrally, tongue-shaped (Figs. 90, 94). Genotype: *Gryllus tergestinus* Charpentier, 1825.........*Epacromius* new genus

The two new genera, together with *Aiolopus,* from which they are separated, should be regarded as members of the subfamily Oedipodinae.

Palaearctic species of the genus *Aiolopus* s. str. require a thorough revision, which will probably reveal the existence of several species confused at present under the name *A. thalassinus* Fabricius, which is regarded as a highly variable species. At the moment I am only able to present synonymic notes on one Palaearctic species.

Aiolopus savignyi (Krauss)

1825. (No name) Savigny, Descr. de l'Egypte, x, pl. 6, fig. 16.

1890. *Heteropternis? Savignyi* Krauss, Verh. Zool.-bot. Ges. Wien, XL, p. 262.

1902. *Epacromia affinis* I. Bolívar, Ann. Soc. Ent. France, LXX, p. 600. (Syn. nov.)

1926. *Aiolopus strepens affinis* Uvarov, Bull. Min. Agr. Egypt, no. 41, p. 21, pl. 2, figs. 25, 26, 27.

1926. *Aiolopus affinis* Uvarov, Eos, II, p. 345.

The figure by Savigny certainly does not represent a *Heteropternis,* as the spurs of the hind tibiae are not specialised, and the pronotum is of a different shape, clearly suggesting a species of *Aiolopus.* The pattern of the elytra is very characteristic for *A. affinis,* and a careful comparison of the figure with Palestinian and Egyptian specimens of the latter leaves no doubt as to their identity.

A. savignyi was known to occur in India, Mesopotamia, Arabia, Palestine, Egypt, Somaliland[49] and Northern Uganda.[50] It was therefore only natural to expect that its area extends also to the Sahara, and I have before me two females taken at Biskra, Algeria, V, 1938 (M. N. Korsakoff).

EPACROMIUS new genus

1853. *Aiolopus* Fieber, Lotos, III, p. 100, (partim).
1853. *Epacromia* Fischer, Orth. Eur., pp. 296, 360, (partim).
1882. *Epacromia* Brunner von Wattenwyl, Prodr. Europ. Orth., pp. 84, 144, (partim).

All orthopterists since Brunner's time have recognised that *Aiolopus tergestinus* (Charpentier, 1825) differs from its congeners in a number of characters, but the differences were considered to be of specific value only. This view was undoubtedly influenced by the opinion that these divergent characters are found in one species only, but I have already shown[51] that the group of *tergestinus* includes at least one more species with the same general characters, separating the two very sharply from the other species of the genus *Aiolopus* which is based on *thalassinus* (Fabricius, 1781) as the type. Since, moreover, the characters in question refer to such important structures as the foveolae of vertex, venation of elytra, the shape of sternal lobes and the male genitalia, I feel it necessary to erect a new genus for the two aberrant species, with the following diagnosis:

Differs from *Aiolopus* Fieber, 1853 (as restricted above), by the frontal ridge being distinctly sulcate in the male and at least concave below the ocellus in the female; by the foveolae of vertex being elongate-triangular and shallow, instead of elongate-trapezoidal and deeply concave; by the mesosternal interspace in both sexes being distinctly constricted behind the middle (Fig. 88); by the discoidal vein being weak and irregularly serrate, running throughout parallel to the posterior radial, and equally removed from it and from the anterior ulnar vein (Fig. 87); as well as by the male subgenital plate being strongly depressed dorso-ventrally, almost tongue-shaped (Figs. 90, 94).

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[49] Uvarov, Bull. Min. Agr. Egypt, no. 41, p. 21, 1926.
[50] Turkana desert, Uvarov, Miss. Sci. de l'Omo, IV, p. 161, 1938.
[51] Uvarov, Ann. & Mag. Nat. Hist., (10), XI, pp. 374–376, 1928.

Members of this genus have been discussed by me in 1928, when three species, with two additional subspecies, were recognised. One of these species, *Aiolopus crassus* Karny, is now referred to a distinct new genus (see p. 345). On the other hand, it appears probable that *Oedipoda japonica* Shiraki, 1910, should be included in the present genus (see p. 343).

The two better-known species can be differentiated, as follows:

Key to Species of Epacromius

1(2). Tarsal arolia broad and not shorter than half the claw (Fig. 95). Antennae stout, their middle joints less than twice as long as broad. Pronotum scarcely sellate. Elytra shorter, not reaching the middle of hind tibia. Lower sulcus of hind femur distinctly reddish (except in green individuals). Male subgenital plate shorter, parabolic (Fig. 94) .... *E. coerulipes*

2(1). Tarsal arolia very small and narrow (Fig. 93). Antennae slender, their middle joints at least twice as long as broad. Pronotum distinctly sellate. Elytra longer, extending beyond the middle of hind tibia. Lower sulcus of hind femur never red or reddish. Male subgenital plate very long, with the apex rounded-truncate (Fig. 90). *E. tergestinus*

Epacromius coerulipes (Ivanov) (Pl. XXVIII, figs. 94 and 95)

1887. *Epacromia coerulipes* Ivanov, Trudy Obstsch., Isp. Prir. Kharkov. Univ., XXI, p. 348.

1907. *Aiolopus tergestinus* var. *chinensis* Karny, Verh. Zool.-bot. Ges. Wien, LVII, pp. 285, 287.

1928. *Aiolopus chinensis* Uvarov, Ann. & Mag. Nat. Hist., (10), XI, p. 377.

1930. *Aiolopus coerulipes* Tarbinsky, Zool. Anz., XCI, p. 335.

1939. *Aiolopus coerulipes* Furukawa, Rep. First Sci. Exped. Manchoukuo, Sect. V, Div. 1, pt. 5, art. 16, pp. 39, 119, 139; figs. 3(6), 4(7), 6(6), 7(6, 12), 8(6, 12), 9(6), 10(6), 11(6), 12(8, 9), 13(6), 14(6, 10), 15(6), 16(6), 17(4, 9), 18(4, 7), 19(6), 20(5); pl. 2, fig. 4; pl. 6, fig. 7; pl. 10, figs. 11, 12, 18; pl. 13, figs. 5, 10; pl. 14, figs. 6, 12, 18, 28, 33.

This species had been confused with *E. tergestinus* until Karny separated it as var. *chinensis,* raised by me to specific status and correctly synonymised by Tarbinsky with *E. coerulipes* Ivanov.

According to Karny, there should be a difference between *coerulipes* and *tergestinus* in the shape of the male supra-anal plate, which he described as broad and obtusely angulate in the former, and narrow, acuminate, in the latter, but my examination of long series of both species failed to confirm this character. Indeed, it appears even that Karny has reversed the descriptions owing to a slip, since the plate in *tergestinus* is actually somewhat broader and shorter than in *coerulipes* (see figs. 90 and 94). This difference, however, is of restricted value, while an absolute distinguishing character is offered by the tarsal arolia (Figs. 93 and 95). The male subgenital plate in *tergestinus* is distinctly longer and more or less truncate apically, while it is always rounded in *coerulipes*. For other characters between the two species see key on p. 339.

The distribution of *E. coerulipes* is insufficiently known, because of the confusion with *E. tergestinus*. Definite records exist for the following localities:

China: Jehol, (Furukawa, 1939);[52] Nanking, (T. L. Tsou); Tientsin, (F. M. Thompson); Kashgar, (Dr. Lansdell); Chungking, (Willemse, 1933).[53] Manchukuo: Tsitsikar, (P. M. Ruf); Harbin, (Jettmar); Mangan, Anda, (Bey-Bienko, 1930).[54] Korea: (Furukawa, 1939).[52] Kangchwo, (E. Scarlett). East and South Siberia, Mongolia: (Tarbinsky, 1930);[55] Vladivostok, (V. Engelhardt); Omsk, Blagovestshensk, Khabarovsk, (Bey-Bienko, 1924);[56] Altai, (Bey-Bienko, 1930).[57] Middle Asia: Lake Balkhash (Omsk Station for Plant Protection). South Russia: Astrakhan, (N. L. Sakharov); Kalmyk region, (A. Doinikov); Kupyansk, Kharkov province, (Ivanov, 1887);[58] Odessa, (Tarbinsky, 1930).[55] Austria: Neusiedlersee (Karny, 1907);[59] Debrecen (Dr. F. Zeuner collection). Italy: Trieste (Krauss).

It appears that the distribution area of *E. coerulipes* occupies a very long, but relatively narrow, belt extending from the Far East to the Adriatic coast. Its distribution is further restricted by its narrow ecological requirements, the species occurring only on salty ground, preferably dry. Such type of habitat becomes increasingly scarce as one moves westwards, and the species can be found in Western Europe only in a few widely isolated areas with extreme xerothermic conditions and saline soil. Karny suggested that this type of distribution may be connected with the dry bed of the Thetys Sea, but there seems to be no need for such a far-fetched explanation. It is much more probable that *E. coerulipes* was a halophilous species of dry habitats in the Angara continent, and its westward extension may have occurred during one of the migrations of the Angara fauna in the postglacial xerothermic period. The present isolated occurrences of *E. coerulipes* in Europe should be regarded as a result of the restriction of its habitat by subsequent changes in climatic conditions.

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[52] Rep. First Sci. Exped. Manchoukuo, Sect. V, Div. 1, pt. 5, art. 16, 1939.
[53] Naturh. Maandbl., XXII, p. 15.
[54] Ann. & Mag. Nat. Hist., (10), V, p. 498, 1930.
[55] Zool. Anz., XCI, p. 335, 1930.
[56] Zool. Anz., LXXXI, p. 70, 1924.
[57] Izw. Zap.-Sib. Geogr. Obstsh., VII, p. 18, 1930. (Sep. repr.)
[58] Trudy Obstsch., Isp. Prir. Kharkov. Univ., XXI, p. 348, 1887.
[59] Verh. zool.-bot. Ges. Wien, LVII, p. 285, 287, 1907.

This isolation of small colonies should favour the development of local races, and Karny stated that the Western European representatives are smaller and more short-winged than the Asiatic ones. More material, however, must be studied before var. *pannonicus* Karny is admitted as a definite subspecies of *E. coerulipes,* to which species it should be referred by the tarsal structure (types examined by me in 1928).[60]

The records of the occurrence of *E. coerulipes* in Austria and Italy (see above) constitute interesting additions to the respective faunas.

Epacromius tergestinus (Charpentier)
(Pl. XXVIII, figs. 87, 88, 89, 90, 91, 92, 93)

1825. *Gryllus tergestinus* Charpentier, Horae Entom., p. 139.
1853. *Epacromia thalassina* var. *tergestinus* Fischer, Orth. Europ., p. 363.
1907. *Aiolopus tergestinus* var. *tergestinus* Karny, Verh. Zool.-bot. Ges. Wien, LVII, p. 286.
1928. *Aiolopus tergestinus* Uvarov, Ann. & Mag. Nat. Hist., (10), XI, p. 375.

There is little to add to my above mentioned 1928 discussion of this species, except that it will probably be necessary in future to distinguish several geographical races. I have now before me abundant material from the following localities:

FRANCE: Ile d'Oléron, Charente-Inférieure, Bay of Biscay. A long series of specimens from the collection of P. Mabille, including a number of co-types of var. *viridis* Mabille, 1906.[61] One of the female co-types is here selected as the type of the variety, the remaining ones becoming paratypes. The majority of Mabille's specimens belong to the typical grey colour form and there are hardly any that can be considered as clearly intermediate between the two colour forms. The name *viridis* Mabille, 1906, and all its synonyms have to be replaced by *flavovirens* Herrich-Schaeffer, 1840 (syn. nov.), since it is undoubtedly this colour form of *E. tergestinus* that was described from Trieste and figured by Herrich-Schaeffer.[62]

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[60] Ann. & Mag. Nat. Hist., (10), XI, p. 377, 1928.
[61] Ann. Soc. Ent. France, LXXV, p. 41, 1906.

RUSSIAN CENTRAL ASIA: Series of specimens from various localities ranging from Astrakhan to Lake Balkhash. On the whole, these are clearly distinguishable from Mabille's series by larger size, more slender habitus and relatively longer elytra. Both the grey and the green colour forms are represented, while there are also green individuals with some grey pattern which can be regarded as intermediate. It is worth recording that the f. *flavovirens* is represented mainly by females, but I have before me also a single male from the Lake Balkhash which clearly belongs to this colour form. The latter is, therefore, probably a genetic colour form mostly of the female sex, but not as completely sex-linked as it appeared to be.

It would be possible to separate the Central Asiatic subspecies from the French one, but the status of the latter is not clear. Indeed, judging by measurements, the Asiatic subspecies is nearer to the true *tergestinus* from the type locality, which is Trieste,[63] while the French specimens are more robust and with shorter elytra. I prefer, therefore, to leave open the question of the Central Asiatic subspecies.

AFGHANISTAN: A short series of specimens from the neighbourhood of Kabul (Wazir-Abad, 4 miles North of Kabul, VI, 20–25, 1938, Dr. S. Akhtar) consists of specimens very similar in size and habitus to the French ones, but remarkable for a considerable degree of melanism. They have heavy black fasciae on the externomedian area of the hind femur, dark-grey or black pattern on the pronotum, and black spots on the sternum and abdomen. The tendency to develop black external femoral fasciae is observed in the French series, as well, but not in the Central Asian. Two of the Kabul females belong to the f. *flavovirens* and do not differ from the respective form of the French insect.

The characters and the status of var. *ponticus* Karny, 1907, cannot be discussed without sufficient material. Karny regarded it as a more northern form differing only in the smaller size. It was described from Siders in Wallis, Switzerland, and I select this as the type locality, others being Wattens in Northern Tirol and Sarepta on the lower Volga. Measurements of the typical pair were given by me elsewhere.[64]

The confusion that existed in the past between *E. coerulipes* and *E. tergestinus* makes it impossible to use old records for the study of distribution of the latter. There are good reasons to think, however, that *E. tergestinus* does not occur in eastern Asia, the most eastern record being Altai.[65] It is very common in suitable habitats (which are of the same kind as for *E. coerulipes*) in the whole of Middle Asia where *E. coerulipes* is found together with it only in the north. Reliable records from Europe are scanty, but *E. tergestinus* is definitely known from Trieste and from the Atlantic coast of France (Ile d'Oléron, see above). It occurs also in the Wallis canton of Switzerland (var. *ponticus* Karny) and in Northern Tyrol (if Karny's record is correct).

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[62] In Panzer, Fauna Ins. Germ., fasc. 157, pl. 19.

[63] See measurements in Uvarov, Ann. & Mag. Nat. Hist., (10), XI, p. 376, 1928.

[64] Uvarov, Ann. & Mag. Nat. Hist., (10), XI, p. 375, 1928.

It appears, therefore, that *E. tergestinus* is primarily a Central Asian species, which subsequently extended its area into Europe, probably migrating together with *E. coerulipes,* with which it often occurs (Lakes Balkhash and Zaisan, Astrakhan, Trieste).

Epacromius japonicus (Shiraki)

1910. *Oedipoda japonica* Shiraki, Acrididen Japans, p. 39, pl. 1, fig. 10.

1939. *Aiolopus japonicus* Furukawa, Rep. First Sci. Exped. Manchoukuo, Sect. V, div. 1, pt. 5, art. 16, pp. 43 and 141.

Shiraki's species belongs certainly to a genus of the group Aiolopi, and Furukawa was probably correct in suggesting that it is allied to *Epacromius tergestinus.* Unfortunately, Furukawa failed to give the characters justifying the specific separation of *E. japonicus* from *E. coerulipes,* except saying that it is larger, with longer antenna, more robust hind femur and the tarsal pulvillus as small as in *E. tergestinus.*

The species was originally described from Takasago, Honshiu Island, and recorded by Furukawa[66] from Miyazaki, Kyushu Island. The last-named locality is described by Furukawa as "one of the warmest places in Japan proper."

PLATYPYGIUS new genus

Two species formerly included in *Aiolopus* cannot be retained in it after its restriction as proposed above, nor can they be referred to the new genus *Epacromius.* They are *Epacromia platypygia* Pantel, 1886, and *Aiolopus crassus* Karny, 1907, and a new genus is erected for them.

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[65] Bey-Bienko, Izw. Zap.-Sib. Geogr. Obstsh., VII, p. 18, 1930.

[66] Mushi, VIII, p. 110, 1935 and 1939, *l.c.*

As will be seen from the key (p. 337), the genus *Platypygius* occupies an intermediate position between the restricted *Aiolopus* and *Epacromius*. It agrees with the latter in the specialization of the male genitalia and approaches it in the structure and position of the discoidal vein, but differs strikingly in the robust habitus; large thick head with quite, or almost, vertical face and non-sulcate frontal ridge; transverse mesosternal interspace, and very short and broad hind femur. Differences from *Aiolopus* consist in the same features of the general habitus, but primarily in the structure of the male genitalia and in the weakly specialised discoidal vein. While, therefore, *Platypygius* may be regarded as a link between *Aiolopus* and *Epacromius*, it has to be treated as a distinct genus, since the alternative would be the reversion to the old *Aiolopus* s. lat., which was clearly composed of heterogeneous elements.

Key to Species of Platypygius

1(2). More slender. Frontal ridge distinctly constricted at the fastigium, in the male weakly concave at the ocellus. Fastigium of vertex narrower, weakly concave; foveolae deeper, with distinct margins, narrowly triangular. Male supra-anal plate with scarcely developed transverse ridge; subgenital plate very large, and strongly depressed, rounded-truncate (Fig. 100) ....*P. platypygius*

2(1). More robust. Frontal ridge very broad, not, or scarcely, narrowed at the fastigium, convex even in the male. Fastigium of vertex broader, not concave, and may be even weakly convex; foveolae shallow, with imperfect margins, narrowly triangular with the apex briefly truncate. Male supra-anal plate with a distinct transverse ridge; subgenital plate moderately depressed, shorter, parabolic (Fig. 101). *P. crassus*

Platypygius platypygius (Pantel) (Pl. XXVIII, figs. 99, 100)

1886. *Epacromia platypygia* Pantel, An. Soc. Esp. Hist. Nat., xv, pp. 241 and 271, pl. 2, figs. 2A, 2B, 2C, 2D.

The original description of this species by Pantel is excellent, as I am able to say from the study of a pair of cotypes now in the British Museum (ex Malcolm Burr collection). It was described from saline meadows on the shores of the Rio Salado near Tarancon, Cuenca province of Spain, and since recorded only by I. Bolivar[67] from Salamanca.

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[67] Cat. Sin. Orth. Fauna Iber., p. 70, 1898.

Platypygius crassus (Karny) (Pl. XXVIII, figs. 101, 102, 103)

1907. *Aiolopus tergestinus* var. *crassus* Karny, Ver. Zool.-bot. Ges. Wien, LVII, pp. 286 and 287.
1921. *Aeolopus burri* Uvarov, Ent. Record, XXIII, p. 155. (Syn. nov.)
1926. *Aiolopus crassus* Uvarov, Eos, II, p. 346.

My redescription (1926) of *A. crassus* was based on a topotype and it should be corrected only with regard to the discoidal vein, which is not as in *Aiolopus thalassinus,* but more removed apically from the radial vein, though not so much as in *Epacromius.* A reexamination of the male type of *A. burri* shows that the presumed difference between this species and *crassus* was due to the subgenital plate in the only male of *burri* being deformed and therefore appearing not flattened as in *crassus.* There being no other differences, the two must be synonymized.

The species appears to occur in a few isolated colonies. It is known to me only from the following localities:

SOUTHERN RUSSIA: Sarepta, (Karny, 1907, l.c.; Uvarov, 1926, l.c.); salt areas on the shores of Siwash, Azov Sea;[68] Odessa, Peresyp, Kuyalnitzky Liman, VIII, 6, 1925, (D. Znoiko). MACEDONIA: Lembet, (Uvarov, 1921, l.c.).

The specimens from Siwash and Odessa are somewhat smaller than those from Sarepta and Macedonia, but otherwise no difference can be detected. According to Medwedew the species occurred together with *Epacromius tergestinus* but was very rare.

Egnatioides coerulans (Krauss)

1893. *Egnatius coerulans* Krauss, Jahresh. Ver. Vaterl. Nat. Wurtt., XLIX, p. XCV.
1896. *Egnatius coerulans* Krauss, Zool. Jahrb., Syst., IX, p. 532, pl. 7, figs. 3, 3A, 3B.

It is strange that Vosseler, when erecting the genus *Egnatioides*[69] for *E. striatus* Voss., did not reconsider the generic position of the closely related *Egnatius coerulans* Krauss. Moreover, he did not even present a definite comparison of his new genus with *Egnatius* and their differential diagnosis has been published but recently by myself.[70]

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[68] Medwedew, Mem. Acad. Sci. Ukraine, VI, (3), p. 405, 1928. Some specimens in the British Museum collection.

[69] Zool. Jahrb. Syst., XVI, p. 361, 1902.

[70] Eos, II, p. 357, 1926.

The genus *Egnatioides* comprises two Algerian species, as well as some Central Asian and Iranian ones. Both Algerian species being known to me from type material, the following key is offered for their separation:

1(2). Generally more rugose. Frontal ridge in profile weakly depressed below ocellum. Fastigium broader, with margins sharply raised; occiput rugose. Pronotum with the median carina acute; lateral carinae distinctly raised. Hind femur stout with two dark fasciae on the inner face. Wings bluish......................*coerulans* (Krauss)

2(1). Generally more smooth. Frontal ridge in profile distinctly depressed below ocellum. Fastigium narrow, with obtuse margin, occiput not rugose. Pronotum with the median carina weak; lateral carinae obsolete. Hind femur more slender, without dark fasciae on the inner face. Wings hyaline............................*striatus* Vosseler

Egnatioides striatus is known to me from the typical series including specimens from Gafsa and Gabes in Tunisia, Djelfa and Bou-Saada in Algeria, while of *E. coerulans* (Kr.) I have also studied the type and some paratypes from Mecheria and a series from Batna, Aurès Mountains, Algeria, VII, 3, 1939 (M. Korsakoff).

Ocneridia volxemii (I. Bolívar)

1878. *Pamphagus* (*Nocarodes*) *volxemii* I. Bolívar, Ann. Soc. Ent. Belg., XXI, p. 69.

1878. *Pamphagus* (*Nocarodes*) *longicornis* I. Bolívar, Ann. Soc. Ent. Belg., XXI, p. 70. (Syn. nov.)

A very long series of specimens before me, collected near Batna and Lambessa in the Aurès Mountains, supplies convincing evidence that the smooth yellowish-green *O. volxemii* and the rugose greyish-ochraceous *O. longicornis* represent merely individual forms of a single species. Exactly parallel variations are observed in *O. canonica* Fischer, which is represented in the British Museum collection by hundreds of specimens taken in a single locality at Sousse, Tunisia.

The species is known to me also from Bouira in the Djurdjura Mountains, and from Djelfa, Algeria.

Ocneridia nigropunctata (Lucas, 1849)

It is practically certain that the Sicilian *O. canonica* Fischer, 1853, is conspecific with this Algerian insect, though they may be distinguishable as subspecies. Unfortunately, I have only limited material from Sicily for comparison with my Algerian series.

Acinipe saharae sulphuripes new subspecies

Type.—♀; Djelfa, Algeria. October 3–4, 1937. (M. Korsakoff.) [British Museum (Natural History).]

♀. Differs from the typical form (from Biskra) by somewhat smaller size, more laterally compressed body, relatively shorter hind femur and particularly by the bright sulphur-yellow colour of the inside of hind tibia, bearing large round blue-black spot at the base of each spine; the spines are yellow, with the apical portion reddish-black turning black at the tip.

Measurements.—Length of body, 57; pronotum, 10; hind femur, 17.5 mm.

The type is unique.

Vosseler [71] has already remarked on the unusual yellow colour of the hind tibia in specimens of *A. saharae* Pict. & Sauss. from Djelfa, while they are bluish-white in the typical race from Biskra.

Pamphagus tunetanus Vosseler

1902. *Pamphagus marmoratus* var. *tunetanus* Vosseler, Zool. Jahrb., Syst., XVI, p. 391, pl. 18, fig. 3.

Vosseler has described this insect as a mere local variety of the Sicilian *P. marmoratus,* but a long series from Tunisia before me is so uniformly different from the typical form, and also from the Algerian *P. elephas* (L.), that a specific separation of *P. tunetanus* is fully warranted.

I am able to record this species from Batna and from Lambessa in the Aurès Mountains, Algeria, VI, 29, 1939, which extends its distribution area to the south.

Orchamus yersini (Brunner von Wattenwyl)

1860. *Porthetis Raulinii* Yersin, Ann. Soc. Ent. France, (3), VII, p. 529, pl. 10, figs. 26–28, (not *Acinipe Raulinii,* Lucas, 1854).

1882. *Pamphagus Yersini* Brunner v. Wattenwyl, Prodr. Eur. Orth., p. 200.

The original *Orchamus raulinii* was described by Lucas [72] from Candia in Crete. Yersin (1860) incorrectly identified with it some specimens collected at Beyrut in Syria and presented their description, from which Brunner [74] has quite rightly deduced that Yersin's species was distinct from that of Lucas. He has, therefore, redescribed it under the name *Pamphagus Yersini,* but has introduced a confusion by quoting its distribution, as follows: "Candia (Yers. c.m.). Ausserdem in Beirut (c.m.)." Thus, two distinct species appeared to occur together at Candia, Crete, one of them extending its area to Syria, as well. Actually, however, Yersin's specimens (some of which Brunner had in his collection) were definitely stated by that author to be from Beyrut,[73] and Brunner's Crete record was due to a mistake. The differences between the Cretan *O. raulinii* (Lucas) and the Syrian (type locality: Beyrut) *O. yersini* (Br. W.) were clearly stated by Brunner; [74] some supplementary data were given more recently by Ramme.[75]

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[71] Zool. Jahrb., Syst., XVI, p. 390, 1902.

[72] Rev. Mag. Zool., (2), VI, p. 167, pl. 2, fig. 2, 1854.

Apart from Syria, *O. yersini* (Brunner v. Wattenwyl) has been recorded from Palestine,[76] but a careful comparison of the Palestinian material before me with that from Syria leads me to regard the former as belonging to a distinct species, described below.

Orchamus hebraeus new species

1893. *Pamphagus Foreli* Giglio-Tos, Boll. Mus. Torino, VIII (164) : p. 7, (not of Saussure).

1935. *Orchamus yersini* Bodenheimer, Arch. Naturgesch., IV, p. 199 (not of Brunner).

Type.—♀; Place of Sacrifice, Mt. Carmel, Palestine. May 13, 1930. [British Museum (Natural History).]

Closely allied to the Syrian *O. yersini* (Br. W.), but differing from it in the following characters:

Size larger. Coloration creamy-grey, with bluish-grey tubercles; elytra very light-grey, with a dense network of brown veinlets; hind femur with indefinite grey fasciae, distinctly rufous along the lower inner carina; knee on the inner side black, with light-yellow edge; hind tibia on the inside greyish-blue, with the spines yellow, black-tipped. Surface of body distinctly more rugulose and tuberculate. Fastigium of vertex more sloping. Frontal ridge obliterated before reaching the clypeus.

Measurements.—Length of body, ♂ 41, ♀ 73; pronotum, ♂ 7, ♀ 13; elytra, ♂ 6, ♀ 10; hind femur, ♂ 18, ♀ 30 mm.

Specimens examined: PALESTINE: Place of Sacrifice, Mt. Carmel, III, 26, 1930, 1 ♂, V, 13, 1930, 1 ♀ (*type*); Emek, V, 19, 1926, 1 ♀, (F. Bodenheimer); Haifa, V, 20–30, 1921, 1 ♀, (P. A. Buxton).

OCNEROPSIS new genus

In the key to the Palaearctic genera of Pamphaginae by I. Bolívar [77] the new genus comes near to *Prionosthenus* I. Bolívar, but differs from it in the following characters:

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[73] Yersin, Ann. Soc. Ent. France, (3), VII, p. 531, 1860.

[74] Brunner, Prodr. Eur. Orth., p. 200, 1882.

[75] Eos, III, p. 192, 1927.

[76] Bodenheimer, Arch. Naturgesch., IV, p. 199, 1935.

[77] Trab. Mus. Cien. Nat. Madrid, VI, p. 8, 1912.

Body not compressed laterally, but distinctly depressed dorso-ventrally. Antennae quite filiform, not at all compressed or expanded basally. Face as broad as high (much higher than its width at the clypeus in *Prionosthenus*). Fastigium of vertex strongly sloping forward, broadly triangular, its postero-lateral carinae imperfect. Occiput globose. Pronotum very thick, obtusely tectiform; median carina moderately raised, thick (in *Prionosthenus* the pronotum is very strongly laterally compressed, its carina very high and thin, crest-like). Mesosternal lobes in the male weakly, in the female strongly transverse; their interspace distinctly transverse even in the male (in *Prionosthenus* the lobes are only weakly transverse even in the female, and their interspace is distinctly elongate in ♂, square in ♀). Metasternal interspace in the male more than twice, in the female nearly four times, as broad as its length (in *Prionosthenus* the interspace is narrow in both sexes). Abdomen in both sexes very stout, without the median crest. Very similar in the general habitus to *Ocnerodes* Brunner.

GENOTYPE: *Pamphagus bethlemita* I. Bolívar, 1893.

The genus *Prionosthenus* was originally based on *Pamphagus galericulatus* Stål, 1876, but later five more species were included in it,[78] with the result that the generic limits became very indefinite. Although not all these species are known to me by specimens, it is possible to clarify the situation to some extent by removing from *Prionosthenus* to a new genus some species which are clearly not congeneric with *P. galericulatus*. Under this arrangement, the following four species would remain in *Prionosthenus: P. galericulatus* (Stål, 1876), *P. syriacus* (Brisout, 1855; listed as *Orchamus* by I. Bolívar, 1916),[79] *P. verrucosus* (Brunner, 1882; possibly synonymous with the preceding), and *P. simulans* I. Bolívar, 1911. The new genus *Ocneropsis* would include, apart from the genotype, also *Pamphagus brunnerianus* Saussure, 1887, and *Pamphagus kneuckeri* Krauss, 1909, although both these species are very distinct and, when better known, will probably be removed from *Ocneropsis*. In the meantime, however, they find a more natural place in the latter than in *Prionosthenus*.

Ocneropsis bethlemita (I. Bolívar)

1893. *Pamphagus bethlemita* I. Bolívar, Rev. Biol. N. France, v, p. 484.
?1893. *Pamphagus foreli* Giglio-Tos, Boll. Mus. Zool. Anat. Comp., Torino, VIII, (164), p. 7, (not Pictet and Saussure, 1891).
1916. *Prionosthenus bethlemita* I. Bolívar, Gen. Insect., fasc. 170, p. 34.

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[78] I. Bolívar, Gen. Insect., fasc. 170, p. 34, 1916.
[79] Gen. Insect., fasc. 170, p. 33, 1916.

Pamphagus foreli Pict. and Sauss. is now a member of the North African genus *Acinipe,* and the occurrence of this species in Palestine is impossible. I believe that the record of Giglio-Tos refers probably to *O. bethlemita,* though his description of the female is insufficient to establish the synonymy definitely. In any case, *Pamphagus foreli* must be omitted from the Palestine list.

Leptea debilis (Finot, 1894)

Originally described from Ain Sefra, Algeria, this interesting Pyrgomorphine has since been recorded only once, from Laghouat, by Vosseler.[80] Mr. Korsakoff, however, succeeded in collecting a good series of specimens at Djelfa, X, 13–17, 1938. According to him, they were found copulating on small half-dry shrublets of *Anabasis, Atriplex* and *Thymus* in dry steppe, mostly on the edges of the best insolated slopes of ravines.

The species certainly deserves to be placed into a genus distinct from *Pyrgomorphella,* as has already been done by Kirby in his catalogue.

OROPODISMA new genus

Small, sturdy, completely apterous, black to ochraceous-brown with weakly pronounced light pattern.

Antennae stout, short, scarcely exceeding the length of head and pronotum even in the male. Face scarcely reclinate. Frontal ridge broad, not sulcate, very weakly narrowed at the fastigium. Fastigium of vertex with broadly rounded margins, distinctly sulcate, especially in the male in which the sulcus is very narrow. Interocular distance distinctly less than the narrowest part of frontal ridge immediately below the fastigium. Eye large, its height at least equal to subocular distance.

Pronotum short and broad, dorsum weakly convex and strongly punctured. Transverse sulci continuous, broad and deep, especially in the male; prozona 2.2 times the length of metazona. Median carina faintly suggested by a smooth line, but not at all raised. Anterior margin of the dorsum with a distinct submarginal sulcus; posterior margin truncate. Lateral lobe a little longer than deep; lower margin strongly sinuate, the projecting portion rounded. Prosternal spine stout, broadly pyramidal. Mesosternal lobes and their interspace tranverse in both sexes.

Abdomen short, moderately slender in male, stout in female, with very weak and obtuse median carinula in female only. Tympanum obsolete, represented only by a depression round the spiracle.

Anterior and intermediate femora in male incrassate. Posterior femur stout and short, less than three times as long as its maximum height; the lower and the upper edge convex in profile.

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[80] Zool. Jahrb., Syst., XVI, p. 389, 1902.

♂. Last tergite with a short furcula. Supra-anal plate rounded-triangular, with a weak median sulcus, the margins of which form a pair of preapical short ridges. Cercus simple, narrowly-triangular, shorter than supra-anal plate. Subgenital plate broadly parabolic in outline.

♀. Supra-anal plate triangular. Cercus very short. Subgenital plate produced in the middle into an acute appendage. Ovipositor valves stout; upper valve with the upper outer edge strongly sinuate and weakly crenate; lower valve with an acute lateral tooth and strongly pointed, curved apex.

GENOTYPE: *Podisma parnassica* Scudder, 1897.

The species on which the present genus is founded has been included by Dovnar-Zapolskij in his genus *Cophopodisma* based on *Pezotettix pyrenaea* Fischer, 1853, as the genotype.[81] The diagnosis of *Cophopodisma* is too brief to be of real value, and the genus has been made to include five species, mostly unknown to the author and very doubtfully congeneric. In any case it is clear that *P. parnassica* cannot possibly be regarded as congeneric with *P. pyrenaea.* Although this latter species is not known to me by specimens, its descriptions by Fischer and particularly by Brunner are quite sufficient to differentiate it generically from *P. parnassica.*

In its general habitus and the texture and coloration of integument the new genus resembles rather some of the smaller and sturdier members of the genus *Conophyma* Zub., than one of the group Podismini. In the shape of the posterior femur, *Oropodisma* is similar to *Podisma,* but has an entirely different type of pronotum, no wings, no tympanum, and very narrow, sulcate fastigium of vertex. From *Cophopodisma* the new genus differs in the structure of vertex, in the stout ovipositor, in short, stout hind femur, in deeply impressed pronotal sulci, and in the type of coloration. Amongst other known genera of the group, *Oropodisma* approaches in its general appearance the Caucasian endemic genus *Pachypodisma* Uv., but the resemblance is due to convergent features probably caused by similar ecology, both genera being restricted to short-grass dry pastures at very high altitudes. *Pachypodisma* is really quite near to *Podisma* proper, while *Oropodisma* cannot be derived from the same stock, and stands very isolated in the group.

Apart from the genotype of *Oropodisma,* I have before me some specimens of a very closely allied species (or only a subspecies), and the genus appears to be restricted to the high mountains of Greece, its representatives being known from Parnassus, Chelmos and Kyllene (Zyria).

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[81] Trav. Inst. Zool. Acad. Sci. U. R. S. S., II, p. 268, 1933.

Oropodisma parnassica (Scudder) (Pl. XXIX, figs. 104, 105, 106)

1897. *Podisma parnassica* Scudder, Proc. U. S. Nat. Mus., xx, p. 113, pl. 8, fig. 3.

1933. *Cophopodisma parnassica* Dovnar-Zapolskij, Trav. Inst. Zool. Acad. Sci. U. R. S. S., I, p. 268.

Scudder's description of this species can be considered quite satisfactory and my figures made from topotypes should make its characters clear. It appears, however, that the types of Scudder were less well preserved than our series and the colour characters as given by him are inexact. Our specimens are not "very dark bronze green," but brownish-black to black. Pronotum is devoid of any pattern, except the light testaceous portion of lateral lobes, and sometimes, in females only, a very indistinct lighter median line. Mesonotum and metanotum are also without light spots, but the small scale-like creases of the integument corresponding to the bases of the missing elytra and wings are always very light buff, almost whitish. Abdomen in all females, and in lighter coloured males, has a sharply defined narrow light median line. Hind femur is testaceous, with a blackish spot at the base of the upper-inner side, and in darker specimens, two weak dark fasciae, also visible only on the upper-inner area and only partly extended on the internomedian area; lower and inner face of the femur is testaceous-yellow (in one female only it is with a pale orange tinge). Hind tibia is honey-yellow, which agrees with Scudder's term "lutescent" which he uses for the male tibia; that of female is described by him as pale green, which is certainly not the case. Still, more incorrect, and contradictory to his own description on p. 113, is his statement in the key on p. 111 that the tibia is "sordid blue." The species has not apparently been available to any orthopterist since Scudder, and its rediscovery by Mr. Grebenchikoff was of great interest, since it permitted me to establish its generic position and to offer the above redescription. Our series was collected near the summit of Mount Parnassus above Arahova, at altitudes from 1900 to 2300 meters, VIII, 12–14, 1939. The habitat is characterized by stony ground, with numerous screens and patches of evergreen shrubs (*Juniperus nana, Daphne oleoides, Astragalus parnassi*). *Oropodisma parnassica* occurred singly and was partly found in the shelter of stones and under them, probably owing to very high winds.

Oropodisma chelmosi new species (Pl. XXIX, fig. 107)

Type.—♂; Above Kalavryta, Mt. Chelmos, Peloponnesus, Greece. 1900–2300 meters. July, 1938. (O. Grebenchikoff.) [British Museum (Natural History).]

Very closely allied to *O. parnassica* Scudder, differing from it in the following characters:

Last tergite of male with a longer furcula, the branches of which are more closely approximated; supra-anal plate more triangular, with a pair of well raised tubercles near the apex (in *O. parnassica* the tubercles are very low and indefinite). Pronotum with a pale testaceous spot on each side of metazona; mesonotum and metanotum with similarly coloured spots adjoining the rudiments of elytra and wings. Hind femur with black pattern as in *O. parnassica,* but much more pronounced, the fasciae extending widely to the interno-median and partly also to the externo-median areas; underside of the femur brownish-sanguineous; hind tibia distinctly reddish.

Measurements.—As on *O. parnassica.*

Specimens examined: GREECE: Mt. Chelmos, above Kalavryta, 1900–2300 m., VII, 1938, (O. Grebenchikoff), 3♂ (including the type), 3♀, 4 larvae.

The habitat of this species was similar to that of *O. parnassica* and is described by the collector as stony pastures with very sparse, almost exterminated, plant cover, of very poor floristic composition. The insects were found mostly under stones, obviously sheltering from high wind, which was blowing persistently.

Oropodisma species

Two females and two larvae of *Oropodisma* collected by Mr. Grebenchikoff on Mount Kyllene (or Zyria) in the Peloponnesus, Greece, 1700–2000 meters, July, 1938, are very similar in the appearance and in coloration to *O. chelmosi,* but I record them separately, as it is not impossible that some differences will be found in the males when this sex is known in the Kyllene insect. It is of interest to note that the forms from closely situated Chelmos and Kyllene, both in the Peloponnesus, are very nearly related, and perhaps even identical, while the species from Parnassus is clearly distinct.

Careful exploration of suitable habitats on other mountains of Greece, and perhaps of Western Anatolia, will certainly lead to discovery of further species of *Oropodisma.*

TETRIGIDAE

Tetrix bolivari Saulcy (Pl. XXIX, figs. 111, 112, 113)

1892. *Tetrix Bolivari* Saulcy in Azam, Bull. Soc. Sci. Lit. Basses-Alpes, 1892, p. 32. (Nomen nudum.)
1901. *Tetrix Bolivari* Saulcy, Miscell. Entom., IX, p. 61.
1922. *Acrydium bolivari* Chopard, Faune de France, Orth., p. 120, 140.
1931. *Paratettix caucasicus* Bey-Bienko, Bol. R. Soc. Esp. Hist. Nat., xxxi, p. 226. (Syn. nov.)

The difference between the genera *Tetrix* and *Paratettix* consists solely in the structure of the vertex, which in the former is usually wider and more projecting forward than in the latter. This character serves well to separate *Paratettix meridionalis* (Rambur) from the commoner Palaearctic species of *Tetrix,* but becomes unreliable when some less known species are taken into account. To the latter belong *T. ceperoi* I. Bolívar, 1887, and *T. bolivari* Saulcy, which on the structure of vertex may be equally well referred either to *Tetrix* or to *Paratettix.* I am inclined to believe, therefore, that no clear dividing line can be drawn between the two genera, unless other characters than the structure of vertex are discovered. The question cannot be finally settled without an exhaustive study of all relevant species, and for the time being the genus *Paratettix* may be left standing. Its formal definition, however, rests on the vertex being narrower than an eye and in this respect both *T. bolivari* and *T. ceperoi* should be referred to *Tetrix,* although they both have the vertex much more narrow than in other species, such as *T. subulata* (L.), and this was the reason that caused Bey-Bienko to refer his species, *caucasicus,* which is a synonym of *bolivari,* to *Paratettix.*

T. bolivari has been described by Saulcy in a key which he supplied to Azam, and recorded by the latter from Aude and Basses-Alpes, as well as from Dieuze in Lorraine, which is the type locality of Saulcy. Chopard, as cited above, recorded it also from Moselle, Lot and Aveyron, as a rare and localized species. I have before me a pair of specimens from the Azam collection, taken at Chabrières, Basses-Alpes; this is one of the localities mentioned by Azam in his first reference to the species, and the specimens may be considered as determined by Saulcy himself. On the other hand, I have some unquestionable specimens of *Paratettix caucasicus* Bey-Bienko from Transcaucasia and Asia Minor, and a direct comparison makes it clear that the latter is a mere synonym of *T. bolivari.* This conclusion is supported by the fact that the British Museum collection proved to contain specimens of *T. bolivari* from a wide range of southern Palaearctic localities, extending from the Basses-Alpes through the Balkans, Cyprus, Asia Minor and Palestine to Turkestan. The full list of localities where *T. bolivari* is known to occur is as follows:

SPAIN: Picos de Europa, Fuenta Dé near Espinama, IX, 1935, (B. P. Uvarov). FRANCE: departments of Aude, Lot, Aveyron, Basses-Alpes, Moselle, (Azam, 1892, l.c., Chopard, 1922, l.c.). ITALY: Schio, prov. Vicenza, 1928, (O. Gray). SERBIA: Kosutnjak near Belgrade, IX, 19, 1937, (O. Grebenchikoff). GREECE: Kavana, Thrace, VII, 4, 1935, (P. A. Buxton); Vardar Plain, Tekele to Kenlike, V, 14, 1918. Galiko river near Salonika, IV, 20, 1918. Near Salonika, IV, 1918, (J. Waterston). My records of *T. subulata* from Macedonia[82] should also be referred to *T. bolivari.* ASIA MINOR: Between Tireh and Ephesus, VII, 20, 1931, (B. P. Uvarov).[83] CYPRUS: Limassol, VI, 6, 1924; Zakaki, V, 26, 1935, X, 31, 1937; Kilani, Krios r., IX, 15, 1937; Mandria, VII, 16, 1937 (G. Mavromoustakis). I. Bolívar's record of *T. ceperoi* from Cyprus[84] should be referred to *T. bolivari.* PALESTINE: Nahr el Zerka, coastal zone; Huleh; Akka; Wadi Kabala (P. A. Buxton). Other Palestinian localities are listed (under *Acrydium subulatum* L. which should be replaced on the Palestine list by *T. bolivari*) by Bodenheimer.[85] TRANSCAUCASIA: Geok-Tapa, prov. Elizabetpol, IV, 3-15, 1912 (M. Burr); Ordubad (Bey-Bienko).[86] TURKESTAN: Tashkent, IV, 1920; Skobelevo, IV, 12, 1920. IRAN: Astrabad.

The differences between *T. subulata, T. bolivari* and *Paratettix meridionalis* are best seen by comparing the appended figures of the head and pronotum (Figs. 108, 109; 111, 112; 114, 115), and the posterior metatarsus (Figs. 110, 113, 116) in the three species.

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[82] Trans. Ent. Soc. London, 1923, p. 155.

[83] See Uvarov, Eos, x, p. 199, 1934, as *Paratettix caucasicus.*

[84] Bolivar, Ann. Soc. Ent. Belg., xxxi, p. 268, 1887.

[85] Arch. Naturgesch., iv, p. 209, 1935.

[86] Bol. R. Soc. Esp. Hist. Nat., xxxi, p. 226, 1931.

Tetrix ceperoi (I. Bolívar)

1887. *Tettix Ceperoi* I. Bolívar, An. Soc. Esp. Hist. Nat., XVI, p. 100.
1887. *Tettix Ceperoi* I. Bolívar, Ann. Soc. Ent. Belg., XXXI, p. 267.
1901. *Tetrix Ceperoi* Saulcy, Misc. Entom., IX, p. 61.
1922. *Acrydium ceperoi* Chopard, Faune de France, Orth., p. 119.
1940. *Tetrix ceperoi* Uvarov, Brit. Jour. Ent., II, p. 72, fig. 11.

This is another little known species of the *subulata* group. Its differences from *T. subulata* were given by me in a recent paper (Uvarov, 1940, l.c.), while it differs from *T. bolivari* by distinctly smaller size, more slender habitus and particularly by the strongly laterally compressed pronotal carina, which is acute throughout. The distribution area of *T. ceperoi* includes North Africa (Tangier, I. Bolívar, 1887, l.c.); Portugal; Spain (I. Bolívar, 1887, l.c.); France (Saulcy, 1901, l.c.; Chopard, 1922, l.c.); Holland (Willemse);[87] Channel Islands (Zeuner);[88] Great Britain (Dorset; New Forest; Uvarov, 1940, l.c.). To these records I am now able to add the following new records for Germany and Italy.

GERMANY: Taunus Mts., 300–800 ft., IX–X, 1937 (K. H. Chapman). ITALY: Tuscany Prov., Lago di Masaciuccoli, near Viareggio, IX, 18, 1937 (F. Zeuner).

Judging from the present data on its distribution, *T. ceperoi* is a Western Mediterranean species, occurring sporadically north to Great Britain, Holland and Western Germany. When more attention is paid by collectors to species of the *subulata* group, the actual distribution of *T. ceperoi* may prove to be more extensive.

PHASMIDAE

Gratidia spinulosa (Brunner) (Pl. XXIX, figs. 117, 118)

1908. *Gratidia spinulosa* Brunner von Wattenwyl, Insektenfam. Phasm., pp. 220 and 228.
1937. *Gratidia spinulosa* Mistshenko, Proc. R. Ent. Soc. London, (B), VI, p. 120.

This species was described from a female taken in Bampur Province of south-eastern Persia, and I take the opportunity to describe the male sex, as well as to record the species from Baluchistan and Afghanistan.

♂. Head and pronotum with a narrow black lateral stripe. Body smooth. Last tergite somewhat widened, roundly excised behind, above with an incomplete and weak median carinula; below on the hind margin with several irregular black spinules, and with a strong spiniform lateral appendage hanging vertically and armed with 1-2 spinules on its body. Cercus weakly incurved, somewhat clavate, hirsute, bristles under the apex being almost spiniform. Vomer large, flask-shaped, with long acute apex.

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[87] Naturhist. Maandbl., XX, p. 4, 1931.
[88] Proc. R. Ent. Soc. London, (B), IX, p. 196, 1940.

Measurements.—Length of body, 60; pronotum, 2.5; mesonotum, 12; metanotum, 11; front femur, 25; hind femur, 19 mm.

BALUCHISTAN: Mach, Bolan Pass, IX, 27, 1930, 1 ♂, 1 ♀, (W. H. Evans). Pattkin, IV, 22, 1931, 1 ♀ (Y. R. Rao). AFGHANISTAN: Dukhtar-a-Kaffir Hill near Kabul, 7500 ft., VII, 5-8, 1938, 1 ♂, (Dr. S. A. Akhtar).

The male last tergite, with its black spinules, makes the species just as easily recognisable as the armature of the thorax in the female, which is quite lacking in the male.

EXPLANATIONS OF FIGURES

PLATE XXV

Fig. 1.—*Gryllomorpha algeriana* new species. Dorsal aspect of appendages of the male supra-anal plate.

Fig. 2.—*Gryllomorpha algeriana* new species. Mesal aspect of one of the appendages of the male supra-anal plate.

Fig. 3.—*Gryllomorpha uclensis* Pantel. Dorsal aspect of appendages of the male supra-anal plate.

Fig. 4.—*Gryllomorpha uclensis* Pantel. Mesal aspect of one of the appendages of the male supra-anal plate.

Fig. 5.—*Iranusa bampura* new species. Ventral aspect of female subgenital plate.

Fig. 6.—*Iranusa khorasana* new species. Ventral aspect of female subgenital plate.

Fig. 7.—*Rhacocleis galitana* new species. Ventral aspect of female subgenital plate.

Fig. 8.—*Rhacocleis korsakovi* new species. Dorsal aspect of terminal tergite of male.

Fig. 9.—*Rhacocleis korsakovi* new species. Cercus of male.

Fig. 10.—*Rhacocleis korsakovi* new species. Ventral aspect of subgenital plate of female.

Fig. 11.—*Rhacocleis graeca* new species. Ventral aspect of terminal portion of female abdomen.

Fig. 12.—*Rhacocleis graeca* new species. Dorsal aspect of terminal tergite of male.

Fig. 13.—*Rhacocleis graeca* new species. Cercus of male.

Fig. 14.—*Rhacocleis germanica* Herrich-Schaeffer. Ventral aspect of terminal portion of female abdomen.

Fig. 15.—*Rhacocleis germanica* Herrich-Schaeffer. Dorsal aspect of terminal tergite of male.

Fig. 16.—*Rhacocleis germanica* Herrich-Schaeffer. Cercus of male.

Fig. 17.—*Pholidoptera lyra* new species. Dorsal aspect of terminal tergite of male.

Fig. 18.—*Pholidoptera lyra* new species. Ventral aspect of subgenital plate of male.

Fig. 19.—*Pholidoptera lyra* new species. Male cercus.

Fig. 20.—*Pholidoptera lyra* new species. Spinules of subgenital plate of male.

Fig. 21.—*Pholidoptera lyra* new species. Ventral aspect of subgenital plate of female.

Fig. 22.—*Pholidoptera chabrieri* (Charpentier). Male cercus.

Fig. 23.—*Pholidoptera chabrieri* (Charpentier). Spinules of subgenital plate of male.

Fig. 24.—*Pholidoptera chabrieri* (Charpentier). Ventral aspect of subgenital plate of female.

PLATE XXVI

Fig. 25.—*Conocephalus hastatus* (Charpentier). Right elytron of male.

Fig. 26.—*Conocephalus hastatus* (Charpentier). Male cercus.

Fig. 27.—*Conocephalus hastatus* (Charpentier). Dorsal aspect of terminal tergite of male.

Fig. 28.—*Conocephalus grebenchikovi* new species. Right elytron of male.

Fig. 29.—*Conocephalus grebenchikovi* new species. Cercus of male.

Fig. 30.—*Conocephalus grebenchikovi* new species. Ventral aspect of terminal tergite of male.

Fig. 31.—*Steropleurus idomenaei* (Lucas). Male cercus.

Fig. 32.—*Steropleurus siculus* (Fieber). Male cercus.

Fig. 33.—*Stenobothrus palpalis* Uvarov. Head and pronotum of male.

Fig. 34.—*Stenobothrus palpalis* Uvarov. Right elytron of male.

Fig. 35.—*Stenobothrus palpalis* Uvarov. Dorsal aspect of supra-anal plate of male.

Fig. 36.—*Stenobothrus palpalis* Uvarov. Ventral aspect of subgenital plate of male.

Fig. 37.—*Stenobothrus palpalis* Uvarov. Terminal palpal joint of male.

Fig. 38.—*Stenobothrus maroccanus* new species. Head and pronotum of male.

Fig. 39.—*Stenobothrus maroccanus* new species. Right elytron of male.

Fig. 40.—*Stenobothrus maroccanus* new species. Dorsal aspect of supra-anal plates of male.

Fig. 41.—*Stenobothrus berberus* new species. Head and pronotum of male.

Fig. 42.—*Stenobothrus berberus* new species. Right elytron of male.

Fig. 43.—*Stenobothrus berberus* new species. Dorsal aspect of supra-anal plate of male.

Fig. 44.—*Stenobothrus berberus* new species. Ventral aspect of subgenital plate of male.

Fig. 45.—*Stenobothrus berberus* new species. Terminal palpal joint of male.

Fig. 46.—*Stenobothrus amaenus* (Brisout). Head and pronotum of male.

Fig. 47.—*Stenobothrus amaenus* (Brisout). Right elytron of male.

Fig. 48.—*Stenobothrus amaenus* (Brisout). Dorsal aspect of the male supra-anal plate.

Fig. 49.—*Dociostaurus curvicercus* new species. Dorsal aspect of terminal portion of male abdomen.

Fig. 50.—*Dociostaurus genei* (Ocskay). Dorsal aspect of terminal portion of male abdomen.

PLATE XXVII

Fig. 51.—*Xerohippus savignyi* (Krauss). Basal portion of antenna of female.

Fig. 52.—*Xerohippus savignyi* (Krauss). Head and pronotum of female.

Fig. 53.—*Xerohippus savignyi* (Krauss). Profile of head and pronotum of female.

Fig. 54.—*Xerohippus savignyi* (Krauss). Foveola of vertex of female. (Much enlarged.)

Fig. 55.—*Xerohippus savignyi* (Krauss). Ventral aspect of ovipositor.

Fig. 56.—*Xerohippus savignyi* (Krauss). Lateral aspect of ovipositor.

Fig. 57.—*Xerohippus cyprius* new species. Basal portion of antenna of female.

Fig. 58.—*Xerohippus cyprius* new species. Head and pronotum of female.

Fig. 59.—*Xerohippus cyprius* new species. Profile of head and pronotum of female.

Fig. 60.—*Xerohippus cyprius* new species. Foveola of vertex of female. (Much enlarged.)

Fig. 61.—*Xerohippus cyprius* new species. Ventral aspect of ovipositor.

Fig. 62.—*Xerohippus cyprius* new species. Lateral aspect of ovipositor.

Fig. 63.—*Xerohippus palaestinus* new species. Basal portion of antenna of female.

Fig. 64.—*Xerohippus palaestinus* new species. Head and pronotum of female.

Fig. 65.—*Xerohippus palaestinus* new species. Head and pronotum of female in profile.

Fig. 66.—*Xerohippus palaestinus* new species. Foveola of vertex of female. (Much enlarged.)

Fig. 67.—*Xerohippus palaestinus* new species. Ventral aspect of ovipositor

Fig. 68.—*Xerohippus palaestinus* new species. Lateral aspect of ovipositor

Fig. 69.—*Xerohippus azami* (I. Bolívar). Basal portion of antenna of female.

Fig. 70.—*Xerohippus azami* (I. Bolívar). Head and pronotum of female.

Fig. 71.—*Xerohippus azami* (I. Bolívar). Ventral aspect of ovipositor.

Fig. 72.—*Xerohippus azami* (I. Bolívar). Lateral aspect of ovipositor.

Fig. 73.—*Xerohippus solerii* (Jannone). Basal portion of antenna of female.

Fig. 74.—*Xerohippus solerii* (Jannone). Head and pronotum of female.

Fig. 75.—*Xerohippus solerii* (Jannone). Ventral aspect of ovipositor.

Fig. 76.—*Xerohippus solerii* (Jannone). Lateral aspect of ovipositor.

Fig. 77.—*Xerohippus sinuosus* new species. Basal portion of antenna of female.

Fig. 78.—*Xerohippus sinuosus* new species. Head and pronotum of female.

Fig. 79.—*Xerohippus sinuosus* new species. Head and pronotum of female in profile.

Fig. 80.—*Xerohippus sinuosus* new species. Foveola of vertex of female. (Much enlarged.)

Fig. 81.—*Xerohippus sinuosus* new species. Ventral aspect of ovipositor

Fig. 82.—*Xerohippus sinuosus* new species. Lateral aspect of ovipositor.

PLATE XXVIII

Fig. 83.—*Arcyptera labiata* (Brullé). Dorsal aspect of head and pronotum of female.

Fig. 84.—*Arcyptera labiata* (Brullé). Right elytron of female.

Fig. 85.—*Arcyptera stenoptera* new species. Head and pronotum of female.

Fig. 86.—*Arcyptera stenoptera* new species. Right elytron.

Fig. 87.—*Epacromius tergestinus* (Charpentier). Discoidal area of the male elytron with false vein.

Fig. 88.—*Epacromius tergestinus* (Charpentier). Sternum of female.

Fig. 89.—*Epacromius tergestinus* (Charpentier). Sternum of male.

Fig. 90.—*Epacromius tergestinus* (Charpentier). Terminal portion of male abdomen.

Fig. 91.—*Epacromius tergestinus* (Charpentier). Head and pronotum in profile.

Fig. 92.—*Epacromius tergestinus* (Charpentier). Head and pronotum in dorsal aspect.

Fig. 93.—*Epacromius tergestinus* (Charpentier). Tarsal claws and arolium.

Fig. 94.—*Epacromius coerulipes* (Ivanov). Terminal portion of male abdomen.

Fig. 95.—*Epacromius coerulipes* (Ivanov). Tarsal claws and arolium.

Fig. 96.—*Aiolopus thalassinus* (Fabricius). Discoidal area of male elytron with false vein.

Fig. 97.—*Aiolopus thalassinus* (Fabricius). Sternum of female.

Fig. 98.—*Aiolopus thalassinus* (Fabricius). Sternum of male.

Fig. 99.—*Platypygius platypygius* (Pantel). Discoidal area of male elytron with false vein.

Fig. 100.—*Platypygius platypygius* (Pantel). Terminal portion of male abdomen.

Fig. 101.—*Platypygius crassus* (Karny). Terminal portion of male abdomen.

Fig. 102.—*Platypygius crassus* (Karny). Profile of head and pronotum.

Fig. 103.—*Platypygius crassus* (Karny). Head and pronotum in dorsal aspect.

Plate XXIX

Fig. 104.—*Oropodisma parnassica* (Scudder). Vertex of male.

Fig. 105.—*Oropodisma parnassica* (Scudder). Terminal portion of male abdomen.

Fig. 106.—*Oropodisma parnassica* (Scudder). Hind femur.

Fig. 107.—*Oropodisma chelmosi* new species. Terminal tergite of male and supra-anal plate.

Fig. 108.—*Tetrix subulata* (Linnaeus). Face of female. Sweden.

Fig. 109.—*Tetrix subulata* (Linnaeus). Profile of head and pronotum of female. Sweden.

Fig. 110.—*Tetrix subulata* (Linnaeus). Profile of metatarsus of female Sweden.

Fig. 111.—*Tetrix bolivari* Saulcy. Face of female. Cyprus.

Fig. 112.—*Tetrix bolivari* Saulcy. Profile of head and pronotum of female. Cyprus.

Fig. 113.—*Tetrix bolivari* Saulcy. Profile of metatarsus of female. Cyprus.

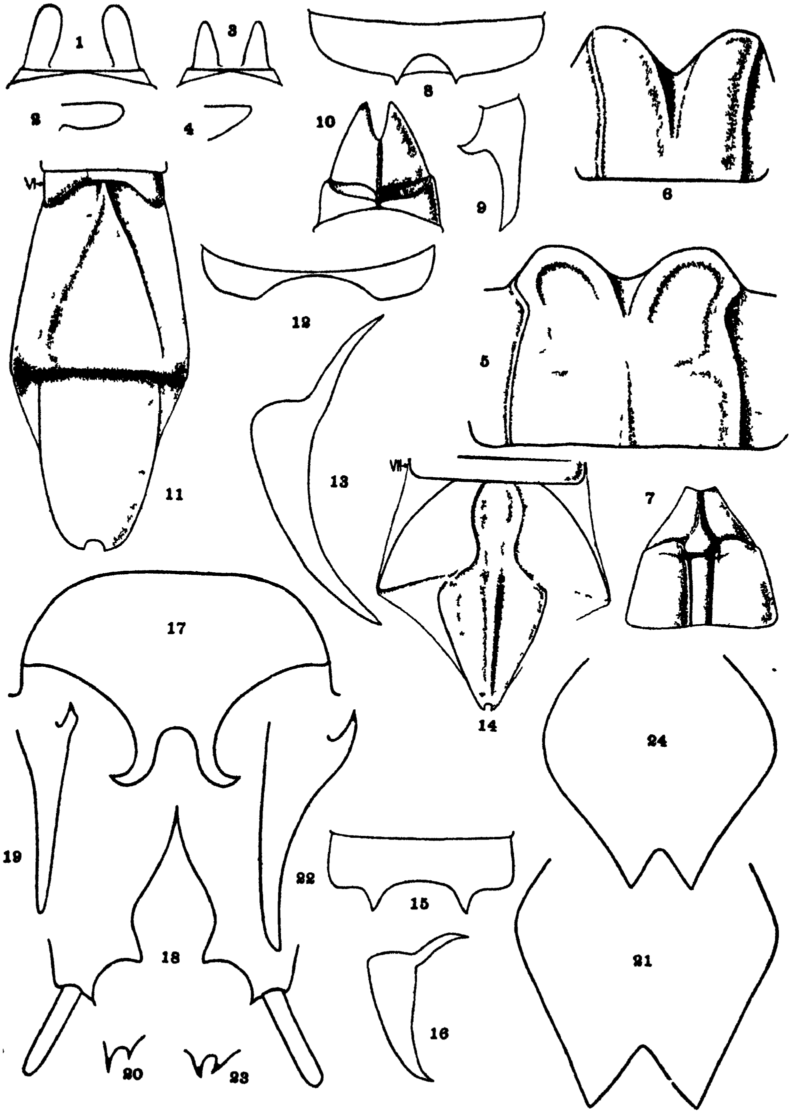
Fig. 114.—*Paratettix meridionalis* (Rambur). Face of female. Andalusia.

Fig. 115.—*Paratettix meridionalis* (Rambur). Profile of head and pronotum of female. Andalusia.

Fig. 116.—*Paratettix meridionalis* (Rambur). Profile of metatarsus of female. Andalusia.

Fig. 117.—*Gratidia spinulosa* (Brunner v. Wattenwyl). Ventral aspect of terminal portion of male abdomen.

Fig. 118.—*Gratidia spinulosa* (Brunner v. Wattenwyl). Lateral aspect of terminal portion of male abdomen.



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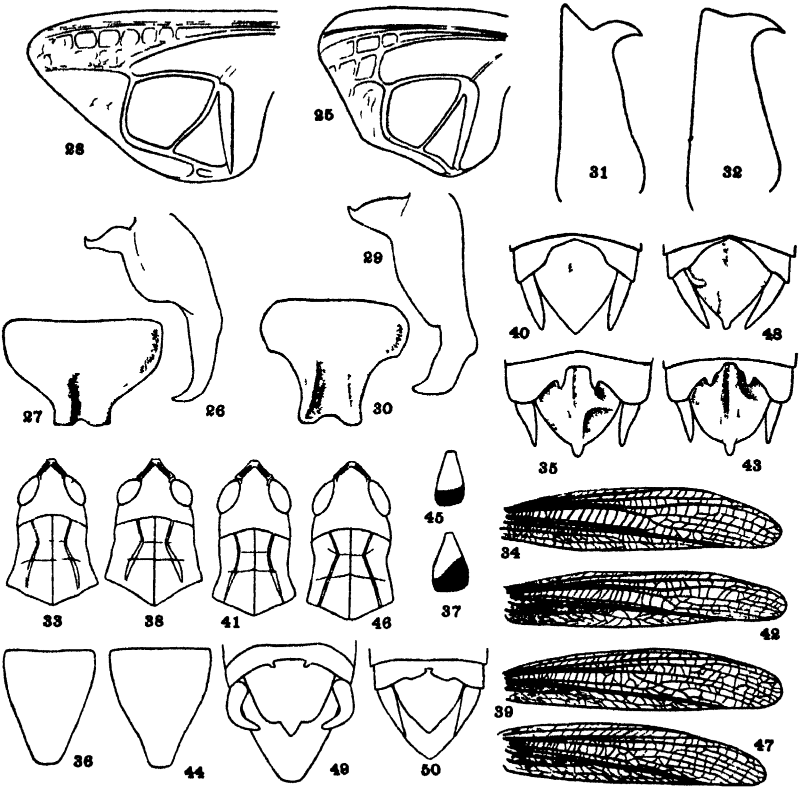

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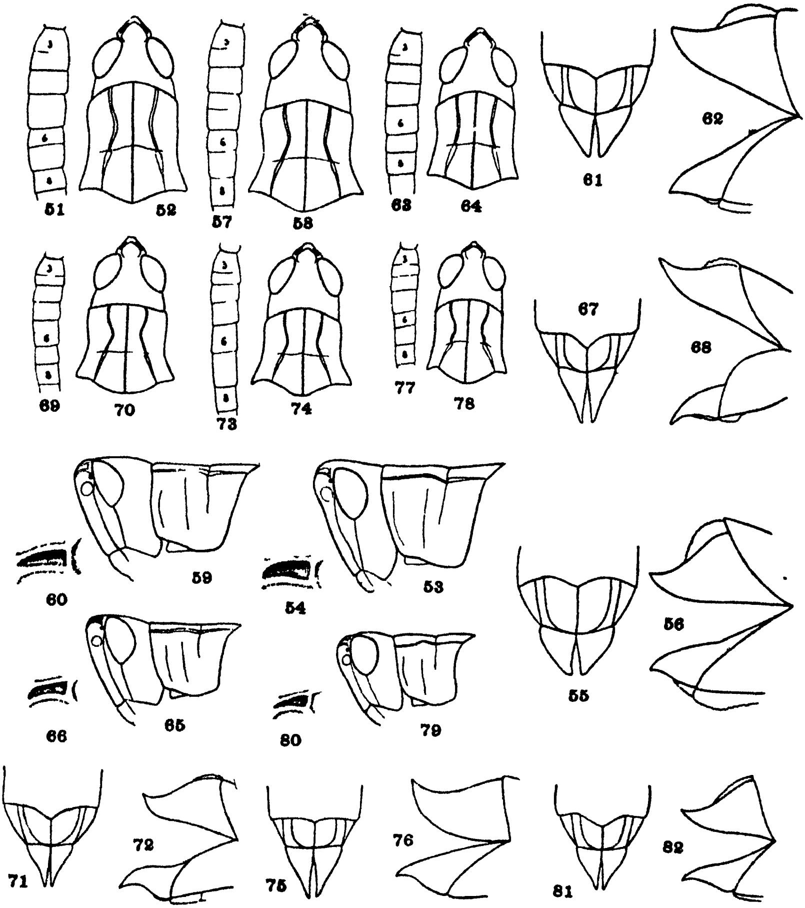

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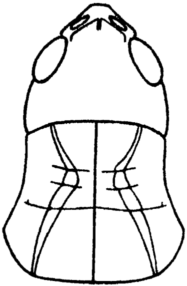

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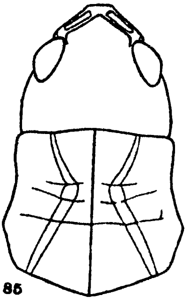

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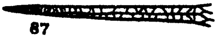

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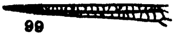

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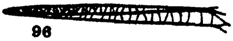

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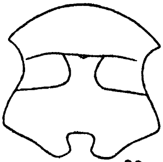

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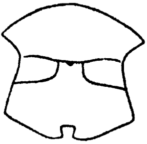

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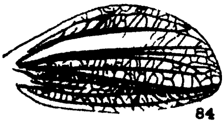

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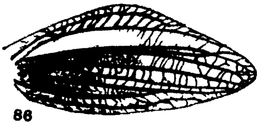

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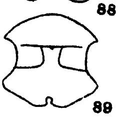

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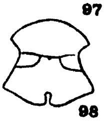

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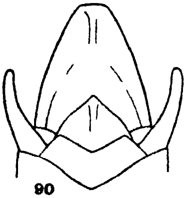

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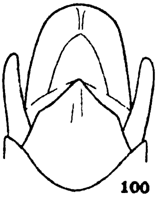

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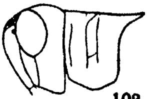

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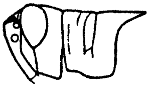

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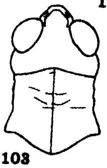

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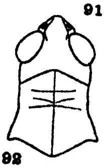

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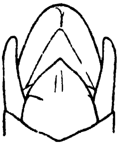

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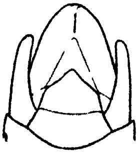

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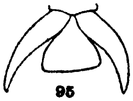

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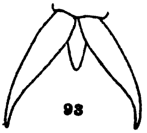

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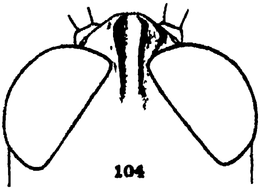
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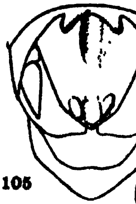
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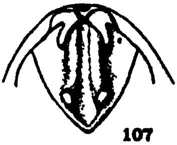
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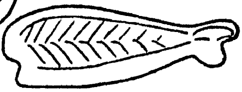
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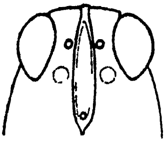
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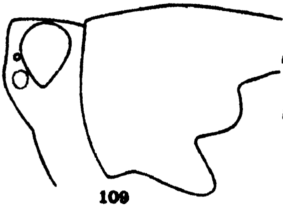
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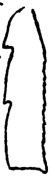
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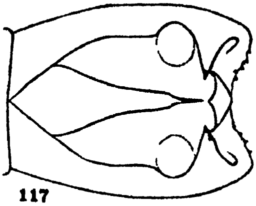
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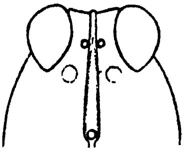
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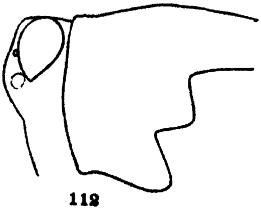
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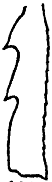
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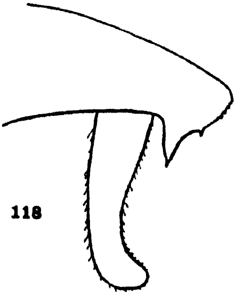
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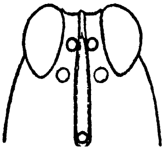
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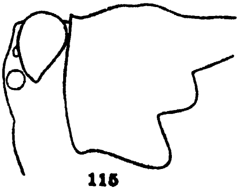
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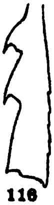
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